THE

ELECTRICAL REVIEW.

VOL. LXVI. APRIL 15, 1910. No. 1,690.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: April 15, 1910. [No. 1,690.

	Page
Electricity in Textile Mills	577
The Need for British Trade Aggression in Turkey	578
Tramway Brakes at the I.E.E.	579
March Export Trade	579
The Driving of Textile Factories: A Comparison between Electric and Steam Rope-Driving (*illus.*)	580
The "Phase Advancer" of the British Westinghouse Co. (*illus.*)	584
Correspondence:—	
Publicity Literature	585
The Reason Why	585
Ringing Bells Automatically	585
Sale of Scrap Metal	585
New Electrical Devices, Fittings and Plant (*illus.*)	586
Our Legal Query Column	587
Engineering Education in Germany	587
Business Notes	588
Notes	594
The Uses of Electricity at the Works of the Manchester Dyers, Ltd. (*illus.*)	595
Electric Individual Drive in Continental Textile Mills (*illus.*)	598
The Electrical Installation at the Collyhurst Finishing Co.'s Works (*illus.*)	602
Electrolytic Bleaching (*illus.*)	603
Apparatus for Textile Factories (*illus.*)	606
City Notes	610
Market Quotations	614
Stocks and Shares	614
Share List of Electrical Companies	615
Proceedings of Institutions:—	
Steam Turbine Driving in Textile Mills (*illus.*)	617
Electrical Operation of Textile Factories	619
Electric Drive in Textile Mills (*illus.*)	619
Parliamentary	620
Legal	622
Foreign and Colonial Tariffs on Electrical Goods	624
New Patents Applied For, 1910	624
Published Specifications	624
Contractors' Column	Advertisement pages 62 and 64

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address.: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ELECTRICITY IN TEXTILE MILLS.

THE electrification of textile mills is a subject which possesses a kind of fascination for the electrical engineer whose heart is in his work, for many reasons. From a commercial point of view, it offers immense possibilities in this country, which possesses about 2,500 cotton mills, with well over 50 million spindles—not far short of half the world's total—each of which mills employs from a few hundred to two or three thousand H.P. of machinery. The woollen trade makes a good second to this record. From a technical point of view, the problem is a thorny one, and therefore attractive to all who rejoice in overcoming difficulties; for the working methods and specialised machinery already employed have been developed to so remarkable a degree of perfection, that there is but a scanty margin of improvement within which to demonstrate the superiority of electrical methods of operation. From the industrial point of view, the electrical engineer casts a longing eye upon the vast field of employment that would be opened to him and to his comrades by the successful solution of the problem, both in the equipment of the mills and in the provision of the necessary supply of power for their needs; and lastly, the cheapening of the cost of production, together with the improvement of the product, would powerfully aid the workers in this gigantic national industry in maintaining and strengthening their hold upon the trade, and therefore is a patriotic object worthy of the highest efforts of every Briton.

That electricity is capable, when wisely applied, of fulfilling the claims made on its behalf we are convinced; and we base our conviction not upon mere wishes that it may be so, but upon the constantly accumulating evidence that it is so. Unfortunately, in spite of the considerable number of mills that have already been converted to electrical operation, the owners of these mills, who come of a hard-headed and secretive northern race, are sadly loath to make known the results of their enterprise, fearing that their immediate competitors would be the gainers, and caring little for the national well-being. Yet their silence may speak louder than words, and possesses a significance that cannot be ignored. Were the results unfavourable, we should soon hear about them, for the Englishman does not easily let pass a sound excuse for grumbling. The very fact that the users of electric power will not tell us what they think of it is, in truth, an invaluable testimonial to its efficiency.

The margin for improvement, as we have said, is small; but so is the margin between the cost of the raw material and that of the finished goods—a matter of a few pence per pound—and hence the greater the need to take advantage of every possible scrap of improvement in the manufacture. The working hours of textile mills are limited by law, and the capital cost of the plant is great; the greater is the need, therefore, to utilise the plant to the utmost while it is run-

ning. It was the electrical engineer who probed the hidden losses of the steam engine, and thereby made possible a remarkable increase in its efficiency; so, too, as the result of his minute investigations, the unsuspected variations of speed at the end of a long shaft have been revealed, and the way has been opened to higher speed and increased output, with improved quality of product, in the textile industry. His ammeter, too, is an unfailing detector of undue friction losses, enabling the user to keep his machinery at the acme of efficiency with ease and certainty.

Owing to the high state of development of the mechanical drive, the electric motor has found it hard to gain a footing in the cotton mill; but history is proverbially prone to repetition, and a similar battle was fought a quarter of a century ago between the gear-wheel and the rope-drive in the same arena. Now, as then, the antagonists are evenly matched, but the better will win—youth will be served. In some departments of the industry, such as the dyeing and finishing processes, the electric motor gains an easy victory, for the conditions are favourable to its use, but in spinning and weaving its chances are not so promising. Nevertheless, it is making headway here also, and the main question in the future will be not whether electric transmission shall be used, but whether the power shall be generated on the spot, or purchased from an outside station. Unless the latter can offer energy at a price in the neighbourhood of ½d. a unit, or even less, it has little chance of preferment; but the fact that in Manchester, for example, nearly 6,000 H.P. is being, or about to be, supplied from the public mains, for driving textile mills, is encouraging. Bolton Corporation drives a quarter of a million spindles, and other local authorities in the north, as well as the Lancashire and Yorkshire Electric Power Companies, are steadily adding to their textile power load. Spinning and doubling mills are the most difficult to tackle, being usually equipped with highly efficient low-speed engines of considerable size; weaving sheds require less power, and are far more amenable to persuasion, while bleaching, printing and finishing mills are the readiest converts to the modern system.

Elsewhere in this issue we give some account of recent installations of electric power in textile mills, and articles showing the superiority of the electric drive. These will be found to contain much evidence in support of the claims that we again put forward on behalf of electricity. In Mr. Milmow's paper, read a fortnight ago before the American I.E.E., some extremely interesting data are given, with curves showing the great variation in power observed in cotton mills—which are generally supposed to have a remarkably steady load—and the variations in speed due to the use of mechanical power transmission. The author's experience, acquired in connection with some 70 mills, driven by steam and by electricity, enables him to speak with exceptional authority, and his evidence is wholly in favour of the latter. Mr. Rothenberg describes the application of the individual drive on the Continent, where it is much more in favour than in this country; and Mr. Crouch ably sums up the advantages of electricity compared with steam for driving mills. We shall resume the subject in an early issue, when we hope to add further evidence of the prevailing merits of the electric drive.

THE NEED FOR BRITISH TRADE AGGRESSION IN TURKEY.

In the Electrical Review for October 8th, 1909, we entered in great detail into the trade outlook in Turkey, urging British manufacturers to make exceptional efforts to secure a large share of the business that was in prospect in that awakening Empire. We have since seen the success that has attended a discreet handling of the telephone concession for Constantinople by an Anglo-French-American co-operation, and we hope that this achievement will encourage others to adopt an equally enlightened policy in seeking the numerous electrical concessions and the large volumes of trade that will be available as development continues at an accelerating pace. But we have reason for knowing that many British manufacturers have approached Turkish propositions with an unfortunate timidity, and it is in the hope that we may be able to do something to remove that weakness that we now proceed to refer to an important presidential address, delivered last month by Sir Adam Block, K.C.M.G., to the British Chamber of Commerce of Turkey. Now, Sir Adam is well worth listening to when he takes as his theme the Ottoman Empire and British trade connections therewith. It is more than 30 years since he entered the British Embassy Office at Constantinople, and he has occupied many offices of distinction in Turkish territory since then. To-day he is one of the directors of the National Bank of Turkey.

He inquired, in the course of his speech, into the causes which are prejudicial to the maintenance of British commercial supremacy there, and purposely ignoring such questions as Consular merits or demerits and Turkish internal characteristics, Sir Adam ran the same risk as others of us have done, of exposing himself to criticism by seeking "the causes of failure in our own deficiencies." It is folly to adopt an ostrich-like policy in regard to such deficiencies, fancying that they are not known to our competitors. As we remarked last week, the latter know well enough that they are making progress in some markets because we have been more neglectful than we should have been, and because they are striving to cope with modern conditions with modern weapons. The British imports into Turkey are still well in excess of those of other countries, but our proportion of the whole in 1908-9 was down to 30 per cent., while that of Germany, France, Italy, and even of Russia, were increasing. Exports to the United Kingdom have dropped to 28 per cent., while those to Austria and Germany are increasing. As to shipping, the percentage of steamers under the British flag has dropped from 37 to 33 per cent. between 1907 and 1910. The point that Sir Adam desired to send right home with these and other figures like them was that the people of the United Kingdom are not making such great strides in the commercial race in Turkey as are others. Among the factors entering into the problem, the speaker believes the chief defect to be our want of organisation at home. By this he means want of combination, for he holds that "where foreign commerce is concerned there must be no rivalry among British merchants and manufacturers." But as he continues: There will not be this combination unless there is something to be gained mutually, the "sinews of war" will not be subscribed unless the benefit is "apparent and assured, and the investment is remunerative;" yet among our rivals such combination and financial co-operation exist, therefore they must have some advantages. He deplores that every manufacturer works independently of his neighbour, his attitude being "I have as much as I want of trade, I will rely on myself, and on my own agent, for foreign export." This Sir Adam describes as a "fine, independent point of view, combined with a feeling of comfortable self-satisfaction and content,"

nt it is not enough that there be a good turnover in the works now, if that turnover is to incline us to let pass the opportunities which will enable others to capture the markets where we ought always to continue to be pre-eminent. "Unless the British merchant bestirs himself, others will in time oust him from his legitimate share in the markets of the world. A market once lost is hard to regain." Sir Adam would like to see a body of British manufacturers at home form themselves into a "combine" comprising any and every category of trade. A "Corporation or Syndicate of British Manufacturers for the Trade in Foreign Countries" would annually subscribe the sum required to obtain from any foreign country the earliest information as to the local requirements of every place. They would, in the first place, form a special commercial intelligence bureaux abroad, and when business was thus presented to them, they might either at once send out their agents, versed in the language required, to treat directly with the purchasers, or have local agents properly recommended to act for them.

A central office at home would tabulate all the information required. Later they would send out qualified men to ferret out openings for business, for mining concessions, grants and monopolies, to establish agencies and to create markets for British manufacturers. . . . . I have myself seen several remunerative enterprises pass into foreign hands because the British author and promoter of the scheme could not find money elsewhere. When we consider that not only does such commercial combination as I have mentioned exist in the manufacturing centres of our rivals and competitors, but that there is a perfect unity of purpose in the nation, that this commercial combination is connected intimately with strong financial combinations which *also* make a speciality of collecting every conceivable kind of information likely to benefit the manufacturer, contractor and concession hunter, and is backed by all the powerful support of a highly and specially trained diplomatic and consular body seeking for every weak spot in the competitor's armour, and which besides collecting and disseminating information on economic subjects is prepared to bring all its political weight to bear to push the interests of the home manufacturer or exporter, is it a wonder that we are losing ground?

Sir Adam says positively that such mutual co-operation "*has got to come if we are not to lose the markets of the world.*"

He is eager, as we all ought to be, that in respect of Turkey the supplanting of British trade by America and Germany should not take place as it has done in South America, and he hopes that British manufacturers will display an interest in the present efforts of the British Chamber of Commerce in Turkey to set up a Commercial Intelligence Bureau. Speaking from observation, he says that the British manufacturer is not so keen as are our competitors to grasp every opportunity. "We do not seem to realise that this market *may become* important, if it has not already become so." It was this coming importance that led us in our recent "Notes on Trade Abroad" to urge our readers to be well in advance in their nursing of such countries as China and Turkey. Sir Adam gave an illustration or two of Turkish contracts that were going, for which Italian, Austrian, and German firms were on the spot, while Britishers were either contentedly occupied at home, or were unwilling to depart from their standard lines of manufacture and produce something adapted to Turkish conditions. In one case a British firm said respecting a contract for travelling kitchens, "Let the Turkish authorities come and see the cars in England!" Austrians sent two cars, Germans one, Italians one, but no such indignity would the Britisher stoop to. His cars they must come and see! Now, how much ordinary common sense does anybody require to know that that is the very last thing they will dream of doing? And, naturally, the impression is fostered that British firms do not want to compete, or to be in the running.

In our earlier treatment of Turkish trade openings we alluded to the combination among French firms in putting up the requisite 10 per cent. deposit money, and British firms were advised to see whether they could not go and do likewise where the sums involved were large. Referring to the country being "practically a virgin field for engineers and capitalists," we urged British readers to note the coming of new projects, and to be ready for them, and we also showed the activity of German-French-Belgian-Swiss banking combinations for exploiting Turkish electrical enterprises. We advocated in the case of Turkey, as in the case of certain other countries, commercial excursions. We even went so far as to urge that an electrical trade tour to some of these countries be organised for electrical business men on the lines that the Institution of Electrical Engineers adopted so successfully a few years ago for studying electrical engineering achievements. The difference would be that the trade tourists would study *prospective opportunities* that they would take advantage of, instead of the technical *achievements* of other nations. English firms send their representatives to conventions in this country where they will meet probable customers and fraternise with them. Why not add, during the coming summer, a combined business holiday of half-a-dozen or a dozen of the leaders among commercial electrical gentlemen to some of the countries where there are chances of doing business?

Tramway Brakes at the I.E.E.

At the last meeting of the Institution an interesting practical paper on electric braking progress on the Glasgow tramway system was contributed by Mr. A. Gerrard, of the tramway staff.

The modern tramway brake is really a very difficult problem, far more so than appears at first glance. It calls for an apparatus which shall efficiently operate under the most divergent conditions, and yet be reasonably simple, fool-proof and weather-proof. Under the circumstances, it is a matter for congratulation that the electric, and particularly the magnetic, type of brake has given such excellent results under severe service conditions. Mr. Gerrard's paper draws attention particularly to the value of a solenoid-controlled shunt resistance in parallel with the fields, for preventing excessive pressure rises in the motor armatures when braking, and incidentally shows the great advance in efficiency of the recent Westinghouse track magnets used on the Glasgow cars.

It is a matter for regret that the author's so-called "1908" brake was not identified in the paper with the well-known Maley brake, which was described in some detail in the Electrical Review of Nov. 29th, 1907, more especially as the results obtained at Glasgow do not appear to have equalled those obtained during the official brake tests carried out at Leeds, Birmingham, &c., by the Corporations and the Tramways and Light Railways Association.

Security is a *sine qua non* of brake operation, and, as one or two speakers pointed out, the purely electrical track-brake cannot be regarded with such confidence as a combined electro-mechanical track-brake on heavy grades, notwithstanding its possible greater energy efficiency.

We think that the Maley brake (or "1908" brake, as the author calls it) should receive some credit for fulfilling this condition of mechanical operation, as it did in the form adopted on the Leeds cars, and described by us; although this, of course, does not detract in any way from the special features of the solenoid-controlled field as particularised by the author.

March Export Trade.

During the month of March the exports from the United Kingdom made a further gratifying advance, the increase in manufactured goods, as compared with March, 1909, being £2,320,083. Textiles account for a large share of this total, but we are glad to observe that there was another leap forward in electrical manufactures, the value of these being £597,516 more, telegraph and telephone cables being chiefly responsible, one item being for telegraph cable for Ascension, £540,000. It appears that for the first three months of the year electrical exports show an advance of £687,512 as compared with the corresponding period of 1909.

D

THE DRIVING OF TEXTILE FACTORIES: A COMPARISON BETWEEN ELECTRIC AND STEAM ROPE-DRIVING.

By L. CROUCH.

The conditions obtaining in a modern textile factory are very peculiar, indeed their singularity has been one of the greatest obstacles to the development of electric driving for textile machinery. There was no analogous service on which to base pioneer work, and the mill owner could not afford experimental installations; nor had he need of the latter, for by the time electrical engineers desired to introduce electric motors, steam and mechanical engineers had been in possession of the field for many years and had developed a highly perfected and efficient system of driving. It was not to be expected that such an equipment should be abandoned in favour of experimental plant employing entirely novel machines, and, in fact, a new operating agent. Electrical machinery was far less reliable then than now, and in any case misfortunes would almost certainly be frequent in such a pioneer equipment. Hence electric motors secured their footing very gradually; they first proved their utility in the few outlying power applications of a cotton mill and in bleach and printing works (which are far less centralised than textile mills), and were then employed where small or temporary extensions of existing plant were desired. Eventually the owners of a mill, in which a very old steam engine was being replaced, were persuaded to give electric driving a trial. This may be regarded as the commencement of a new era: the experiment was successful, and since that date numerous old mills have been converted to, and new mills laid down for, electric driving. In new mills electric driving shows to the best advantage, since the building itself and its whole arrangement can then be designed to suit electrical operation, instead of being *designed* for a steam rope-drive and *adapted* to an electric drive.

Many British mills to-day contain comparatively new steam-driven mechanical transmission equipments: hopes for the early conversion of such to electric driving would be as unreasonable as unfounded. It is shown below that electric driving may be fairly claimed to have important advantages over steam driving, but the net advantage is in no case so great as to justify the scrapping of a modern mechanical drive. No revolution is to be anticipated—electric driving will, by the steady demonstration of moderate, but sterling advantages, be adopted in most new mills, and in existing steam mills as replacements or extensions of plant become necessary.

A smaller percentage of the total horse-power of textile mills is electrically operated in England than in the U.S.A. This is not due to reluctance or prejudice on the part of British mill owners so much as to the great availability of water power in America and to the comparatively recent inception of many of the American schemes. Again, the mechanically-driven mills of Lancashire and Yorkshire show a perfection and efficiency not reached by American mills driven on the same system; the inducement to employ electric drive is, therefore, greater in the latter case.

The salient peculiarities to be noted by the electrical engineer who desires to meet the conditions by the evolution of a special class of machines—and without such special study success is impossible—are:—

1. The high load factor and the strictly limited working hours.
2. The high space factor and few auxiliary machines.
3. The mechanically unfavourable material to be dealt with.
4. The abnormal atmospheric conditions.
5. The fire risk.

1. The working hours in textile mills are stringently regulated by legislation, and since lost time cannot be made up by overtime, the experimental running of machinery is confined to a minimum except in such mills as can afford an experimental department apart from the ordinary manufacturing machines. The latter must run at full load for as long as possible, hence the full load of a 1,000-1,500 H.P. mill may be maintained 55-56 hours per week. About 2,750 full-load working hours are secured per annum, and the annual load factor therefore stands at 30-33 per cent., the plant load factor being 92 per cent., or higher. These exceptional conditions favour the cheap generation of power within the mill itself: to this point reference is made later.

2. The greatest single mistake made in the past by electrical engineers, when urging the substitution of electric for rope drive, was that of applying to textile driving the arguments so well borne out by experience in the electric driving of general engineering and manufacturing workshops. Cotton mills, more than any other manufacturing works, utilise the available floor space to a surprising degree; here are no scattered machines driven by a long common shafting, the auxiliary machines are few in number and near the main machines. Thus many of the arguments so incontrovertible in average engineering shops now collapse. There are no long lengths of shafting, supplying isolated machines, to be replaced by direct-coupled motors—the average length of shafting per machine in textile mills is only some 10 ft. (mules and looms require 9 to 10 ft. apiece, as a rule, but ring frames may need as little as 2 to 3 ft. each on the average).

There is no shaft running all day long to supply an occasional demand—the whole plant runs at full load for perfectly definite periods, and is then completely shut down. The auxiliary machines demand 10 to 15 per cent., or 20 per cent. at the outside, of the total power—they are auxiliaries in little else than name, for, so far as concerns the power transmission engineer, they are every whit as satisfactory as the "main" machines.

3. The mechanical weakness of cotton fibres results in the strictest uniformity of speed and torque being enforced in the driving of spinning machinery. Electric driving substantially aids the fulfilling of these requirements, but the conditions are so severe as to call for special care in the choice of a motor (see later).

4. The abnormal atmospheric conditions in cotton mills include artificial humidity and heat. The correct temperature of a mill room being about 85° F., the motor windings easily attain 150°-165° F., which, in conjunction with the highly saturated atmosphere, affords every opportunity for insulation troubles. However, insulating materials withstand equally severe tests in mining and crane service, and this difficulty has not proved a permanent one.

5. The fire risk in textile mills is exceptional, as has been proved by repeated disastrous fires in the past. Electric motors are, however, safely used in explosive works and in fiery mines, hence their use in textile mills will not involve any added risk. In this respect true squirrel-cage induction motors (not those with semi-"wound" rotor) have the advantage over all other types of having no sliding contacts at which sparking is possible. Where rotor or other resistances are required in textile mills they must be of liberal proportions, since the permissible temperature rise is limited and the radiation facilities are restricted by the high temperature of the surrounding atmosphere.

Various Classes of Textile Machinery and Suitable Driving Motors—A.C. v. D.C.—Group v. Individual Drive, &c.

The problems considered in this section cover a very wide field of practice, but conclusions are generalised as far as is justified by the diverse conditions obtaining in various mills. The chief textile machinery which need here be considered may be classed under the three headings:—(1) Preparation machinery; (2) spinning machinery; (3) weaving machinery.

1. The preparation machinery includes the bale breakers, the blowing machines, the scutchers, carders and combers, and the roving and intermediate frames (these frames are, to a certain extent, spinning machines).

2. The spinning machinery includes the mules, or the ring doubling and ring spinning frames.

3. The weaving machinery includes the looms themselves.

The preparation machines are usually driven in groups, because their power demand is rather uneven, and they are continually at work. Capital expenditure is reduced by so grouping the machines, and the driving motor may be direct-coupled to the line shaft or connected by belting or

ropes. Among the spinning machines, ring frames spin continuously, whereas the 1,000-1,300 spindles of a mule frame are continually reversed. The continuous running of the ring frame is an advantage from the present point of view, and avoids the severe peaks occasioned on mules by the repeated reversal of 1,000 or more spindles running at 9,000-10,000 R.P.M. In rope-driven mules the rope slips somewhat at the moment of reversal, a circumstance fortunate rather than otherwise, while in electrically-driven mills either group driving must be adopted for the mules or abnormally large motors must be fitted for individual driving. The motor runs for so many hours at practically full load that its rating must be considerably increased (in cases of unit drive) to allow for these peak demands. To avoid this installation of large "unit" motors—wasteful of space, material and money—group driving of mules should invariably be adopted. Occasionally only two are grouped, but groups of four or six are more usual. The motor capacity installed on each group should be able to deal with the full-load demand of all the mules in the group plus the possibly synchronous peak of two of them.

Mechanically driven ring frames will not spin such fine counts or deal with such poor raw material as mules, owing to the varying tension on the yarn. When pulling off the nose end of the cop, the pull is almost radial, and is considerably greater than at the shoulder, where the pull is more nearly tangential. To even up matters, the speed should be increased when working on the larger diameter. With a mechanical drive such an increase in speed is impracticable, but, by the use of repulsion motors with movable brushes (operated automatically, say, by the rise and fall of the bar feeding the cop), rapid yet smooth variations of speed can be obtained; the frame output is thus increased and poorer material can be handled.

Ring spinning frames give a practically steady load, usually between 5 and 10 H.P., and are thus suitable for individual driving. Speed control must be allowed for, however, since different grades of material require different treatment. In the case of direct-coupled induction motors, this involves the use of variable rotor resistance. The latter involves, in turn, higher capital cost and lower machine efficiency. All possibilities of slip and belt losses are avoided by direct coupling. Group driving of ring frames is, however, usual in England; a suitable motor is direct coupled to the line shaft, whence a countershaft on each frame is belt or rope-driven. Where long line shafts are thus driven, it may be well to sub-divide the total horse-power required, and fit two

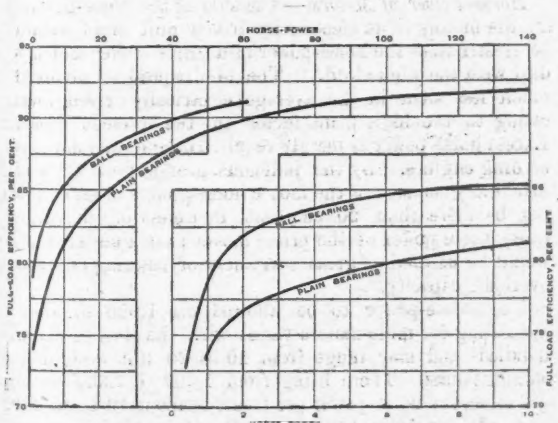


Fig. 1.

or three motors symmetrically along the shaft. Oscillations at the machines most remote from the motor, due to shaft torsion, are thus avoided.

Weaving sheds are generally driven by one large motor apiece, or by a few "group" motors, though individual loom motors of excellent reliability and efficiency are now available. Wherever motors of less than 5-10 H.P. are used, ball bearings should be insisted upon. These increase the cost of the machine somewhat, but add greatly to its efficiency, the improvement being 5-10 per cent. in the smallest machines. In this connection, reference may be made to fig. 1 (see also "Modern Electrical Machinery," L. Crouch, Electrical Review, October 22nd, 1909, pages 644-647).

Group driving is at present standard throughout textile mills, and appears likely to remain so; direct driving of group line shafts is becoming more and more general. There is little or no advantage in coupling the motor to the shaft through ropes, as has been the practice in the past. The line shaft speed necessary to enable direct coupling to a standard induction motor (see fig. 2) is considerably in excess

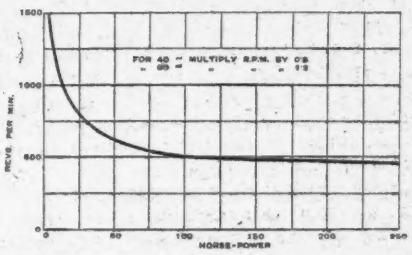


Fig. 2.

of the shaft speeds usual in old mill practice, but there is no reason why it should not be, and the use of nearly equal pulleys on the line shaft and frame countershaft gives the best possible drive.

The electric driving of textile mills, to be successful, must be supported by a thorough adaptation of all the circumstances and arrangements to the requirements of the new agency, or as far so as is reasonably possible in cases of conversion—just as, in the past, the whole scheme has been devised in accordance with the requirements of steam driving.

There has been much discussion as to whether A.C. or D.C. machines should be used; where choice is possible there is little doubt that A.C. motors are to be preferred. One is rather apt to regard the D.C. motor as greatly superior to A.C. types for steady driving of all descriptions. It is found, however, that three-phase induction motors follow variations in load with very little fluctuation in speed; they are superior even to specially designed D.C. shunt motors in that the latter have a time lag in retaining their steady speed on a rapidly fluctuating load. The R.P.M. of a good modern multi-crank engine or turbine are very constant, moreover, the angular velocity during each and every revolution is practically constant, yet at the far end of the shafting, in the departments most remote from the prime mover, a 15 per cent. to 20 per cent. fluctuation in angular velocity can frequently be detected. The cause of this magnification of irregularities and insertion of previously non-existent oscillations is the torsional twist of the shaft, which is considerable in long lengths, and which varies with every fluctuation of load along the shaft. Using direct-current shunt motors driving sufficiently large groups of machines for this torsional swing to become serious, the resultant pulsations in shaft speed (due to motor peculiarities + torsional oscillations of the shaft) may rise to 20 per cent., whereas by the use of three-phase induction motors this variation may fall to 5 per cent., or less. The use of the latter machines enables the uniformity of speed of the prime mover to be reproduced at every line shaft or individual machine, as the case may be, hence the better results achieved.

Squirrel-cage motors represent the acme of simplicity, reliability and safety, and should always be used if speed control is not desired and if the horse-power is not greater than 100-150 H.P. Above this limit wound rotors should be employed. For normal cases where speed regulation is desired, a wound-rotor induction motor with regulatable rotor resistance should be employed: squirrel-cage motors and a countershaft with cone pulleys form the alternative arrangement. Where rapid, efficient and smooth speed variation is desired, repulsion motors with movable brushes are coming into common use. Special precautions must be taken to guard against fire risk where slip rings, commutators, or rotor resistances are used.

Small induction motors may be started directly on the mains, or through an auto-transformer if the starting current would otherwise be too great; in either of these cases a

friction clutch between the motor and its load would be necessary. Motors with "wound" rotors, or with temporary starting rotor resistance, offer no difficulties in starting. In many cases the bulk of the motors in a mill are started up with the main engines, the whole plant running up to speed together, and, of course, on no load; no starting resistances or auto-transformers are then required.

Use of Fly-wheels.—A certain fly-wheel effect between motors, driving, say, mules, and their load is beneficial (and should be as near the headstock as possible). The motors employed have, however, of necessity, practically constant speed characteristics on variable load, and *hence cannot utilise any inertia provided in the moving system;* the smoothing effect of inertia in any moving system depends entirely on a preliminary fall of speed. If, as should be the case, the motor is so designed that this preliminary fall in speed is negligible, it is obvious that any inertia provided is useless. The inertia of the heavy rotating cylinders of carding engines is, however, valuable.

In rope drives fly-wheel effect is more necessary and can be better utilised (these two conditions being mutually contingent) owing to the considerable cyclic fluctuations already noted. The prime cost of rope gearing is nearly as high as that of tooth gearing, while the upkeep cost is heavier; the advantage of the rope transmission is generally recognised as having sprung from the considerably greater inertia of rope pulleys than of equivalent gear wheels. Mechanical drives (from line to countershafts, &c.) should be by good flexible and slack cotton rope rather than by strap or belt; a considerable advantage of efficiency rests with the former. In earlier equipments it was common to suspend a group motor from ceiling girders, coupling it to the line shaft through ropes; later practice is to directly couple the motor to the line shaft, the motor being mounted on end-wall brackets, or, better still, placed at the centre of the line shaft.

The placing of electric motors relative to the machines they operate is not always ideal or even satisfactory: too often, in cases where a mechanical drive is being superseded, the millowner stipulates that no movements or alterations of the textile machines are to be allowed. As a result, a certain percentage at least of the motors have to be unfavourably placed, and connected to their work through more or less complex and inefficient millwrighting. Only where the new installation can be designed with an absolutely free hand can the full capital and operative advantages of electric driving be realised.

Friction Losses.—The friction losses between prime mover and ultimate load (textile machines) are considerably less in electric than in mechanical mills, but in the former case the cable and motor losses are appreciable, especially where many small horse-power individual-drive motors are employed. The net result is a close balance between the overall efficiencies of mechanical and electric systems. The friction losses can be accurately determined where electric drive is used, but in mechanically-driven mills, though a "friction" indicator diagram can be taken from the mill engine when driving all the shafting and roping dead light, the separation of frictional losses on full load is impracticable. Results of various tests all claiming to be quite authentic have shown, on the one hand, electrical equipments to suffer from the higher friction loss by 3 per cent. to 10 per cent.; and on the other, mechanical installations to have friction losses higher by 10 per cent. to 20 per cent. Probably there is little to choose between rope and electric drive in this respect, the advantage, where any, being usually on the side of the electrical equipment. It is generally assumed that from 5 to 15 per cent. less I.H.P. is required at the prime mover in electrically than in mechanically-driven mills for the same textile machinery. Some engineers, however, will only admit a greater output for a given horse-power in the case of electrical operation, and maintain the same horse-power of prime mover to be necessary in both cases.

Uniformity of Torque and Speed and Effect of same on Output.—Though electrical and rope-driven installations run one another so closely as regards mechanical efficiency, in equally modern equipments there is no doubt that electrical operation gives the greater uniformity of torque and speed, and so enables higher speed and output without increased risk of breakages of yarn. Again, this more uniform working results in a higher quality of product. In some cases the fitting of "unit" electric motors has necessitated a reduction of the number of spindles per frame; this reduction, of 5 or 7 per cent., is, in such cases, a strong argument in favour of group driving, since it largely abolishes the net increase in output of the frame. Even presuming that no net increase of output be obtained, the quality of electrically-woven material is so much superior to that made in mechanical mills as to obtain a definite rating as a *higher grade material fetching a higher price on the open market.*

An immediate consequence of the more uniform torque and speed of electric motors (a three-phase motor will be subject only to the cyclic variations of the turbine or reciprocating engine driving the supply alternator, which seldom exceed ¼-½ per cent.) is reduced wear and tear of bearings, shafting and what roping is still required. This, together with the abolition of the bulk of the roping and much of the shafting and pulleys required by mechanical drives, more than compensates for the heavier total depreciation on the electrical equipment (the percentage rate being still the same or less, but the capital being greater).

Reliability.—The reliability of an electrical installation is certainly no less at the present day than that of the best mechanical equipment. Electric motors now run year in, year out under the most unfavourable conditions, with no more than occasional inspection, insulation testing, and commutator and brush cleaning and trimming. The latter being absent in most textile motors, possibilities of failure are still further removed. Such a trivial breakdown as the seizing of a bearing in some remote part of the transmission has, before this, temporarily disabled a large part, or the whole, of a mill: needless to say, with electric drive on individual machines, or reasonably small groups, no such contingency is possible.

This independence of one group of machines, or even of one machine, of another at once enables simple and accurate checking of the power taken by each. Inefficient working is at once detected, and *its source isolated and removed.* In mechanically-driven mills the working of the whole plant can be checked by noting weekly the output as compared with the coal consumption: more detailed investigation is practically impossible.

Any breakdowns in electrical equipment can be rapidly repaired, owing to the high degree of standardisation now usual in the latter.

Horse-Power of Motors.—The sum of the horse-powers of all the motors in an electrically-driven mill must naturally be greater than the horse-power of a prime mover which will deal with the whole load. The idle capital so involved is much less than in the average electrically-driven factory owing to the high plant factor in the present instance. Excess horse-power is mainly required on spinning mules and carding engines. By the judicious grouping of the textile machinery the sum of the motor horse-powers need certainly not be more than 20 per cent. in excess of the normal rated horse-power of the prime mover; such an installation would be assured of great steadiness of running and ample overload capacity.

The horse-power to be allowed per 1,000 spindles in estimating for mule motors varies with the class of material handled and may range from 10 to 20 H.P. according to circumstances. There being from 1,000 to 1,300 spindles per mule, the horse-power per frame is about 10 to 25 H.P.; units of from 50 to 100 H.P. are therefore suitable for mule group driving. Ring spinning and ring doubling frames require a fairly steady input of from 5 to 10 H.P. each.

Capital Costs.—The relative capital costs of mechanical and electrical installations are here treated very cursorily. Individual cases differ so greatly that to attempt more than the most rudimentary treatment would require more space than is here available.

Distinction must be made between new mills and those in which electrical is replacing mechanical drive. In the former case £500-£700 is at once saved by the absence of the rope race, and the whole building may be of lighter construction than when heavy shafting has to be carried throughout the mill. The arrangement of mills on the "shed" principle, so desirable from the mill-

owner's point of view, is difficult or impossible with mechanical drive, but is readily effected by electrical operation. The total capital cost of a *new* electrical mill is little, if any, greater than that of a *new* mechanical mill; if energy be purchased from a supply company, the capital cost is much less (usually half to one-third the conversion costs cited below).

In the case of *conversions*, the rope race and building economies cannot be secured; indeed, structural alterations may have to be made which will impose a further capital burden on the new system. In the case of a mechanically driven mill in which the gearing, when new, cost about £3,000 and the rope race, stairs, &c., £600, the gearing and pulleys required in the equivalent electric drive would cost £700—£900, and the motors, cables, switches, auto-transformers, &c., £3,500. The existing steam engine (costing £5,000—£6,000 new) may be replaced by a turbo-alternator, which, with auxiliaries, costs £6,000—£7,000. The total cost of boiler, engine, roping and gearing in the mechanical mill being about £18,000, the capital cost of conversion to electric drive, assuming the use of the old engine, boiler and economiser houses, and the old boilers, chimneys, reservoir and heating plant, would be about £11,000. The cost of replacing the old by modern mechanical drive would be about £9,000, under the above general conditions. The total capital cost of a *conversion* to electric driving is usually 10 per cent. to 20 per cent. in excess of the cost of *renewing the existing mechanical drive* and assuming "*home*" *generation* of electrical energy (*vide infra*).

Annual Costs.—The upkeep cost of induction motors is little, if anything, in excess of that of shafting and roping. The absolute simplicity of the polyphase squirrel-cage induction motor has largely contributed to its wide adoption in textile driving. Owing to the higher capital cost of the transmission arrangements between the prime mover and the textile machinery, the annual costs, even on a lower depreciation rate, are higher for electrical systems. The total annual excess rarely exceeds 5 to 10 per cent., and is more than covered by the higher output of better material.

Prime Movers and Stand-by Plant—"Home" Generation *v.* "Imported" Energy—Power Costs.

The alternative prime movers in mill practice are low-speed reciprocating engines (by far the most commonly used), high-speed reciprocating engines (possessed of more uniform torque than the former, but subject to a heavier depreciation and costing more for repairs), and steam turbines (moderate in capital cost, light, yielding perfectly uniform torque, and, if properly treated, subject to low depreciation). No stand-by plant is now necessary as regards the prime mover, whether the latter be a reciprocating engine or a turbine. These remarks also apply to electrical generating plant. The provision of a stand-by equipment necessitates idle capital, and probably decreased efficiency of running; it indicates, or might reasonably be assumed to indicate, lack of confidence in the reliability of the equipment. If stand-by is really deemed necessary, it is better to purchase energy from a supply company, so securing the use of their ample stand-by plant, and at a minimum cost.

Should a mill generate its own electrical energy or purchase it from a supply company? The chief factors concerned in this problem are capital and running costs and reliability. Unfortunately these are complicated by the necessity for heating the mill. This necessity is peculiar to the textile industry, and exercises an influence which has seldom to be taken into account in determining the relative advisability of "home" and "foreign" generation in other factories. Artificial heat and moisture are necessary to bring the cotton fibres to the most tractable condition; but, so long as home generation is adopted, the engine exhaust and live steam are available for heating purposes. The heating problem presents a considerable stumbling-block when "imported" energy is desired.

In a mill of 80,000-100,000 spindles, from 5 to 15 tons of coal must be burnt per week to heat the work rooms alone, according to the construction and arrangement of the mill and according to the season—this is in addition to the frictional heat evolved by the running machinery, which may itself amount to nearly 10 per cent. of the calorific value of the total fuel burnt. The necessity for heating alone involves a fairly large boiler plant even should all the electrical energy be imported. The necessity for excellently lighting mill rooms involves a large window area per 100 sq. ft. of floor, and hence an exceptionally high radiation loss in cold weather. Fortunate coincidences which remove the above difficulty with regard to imported energy are:—

(*a*) A steam mill or central station near the electrically operated mill and able to afford the required heating supply of steam.

(*b*) The co-operative electrical supply of a group of mills from a central station near all of them, so enabling a similar co-operative steam supply therefrom.

By importing energy the millowner saves considerable capital expense, and can more profitably invest the latter in textile machinery; on the other hand, he must pay, in his price per B.T.U., not only the central-station "works" costs for its generation, but also the station capital charges on the same. The "works" costs at the central station will probably be rather lower than the millowner could reach in his own plant, though this difference will usually be very slight. The central-station capital charges per unit will be less on the large prime movers and generators than on the millowner's smaller units, but the charges on buildings and land will be heavier in the former instance, the space they would occupy in the mill being meanwhile more or less idle. The mill owner has to pay his share of the cost of the distributing system of the station, and of the higher percentage interest at which the latter usually borrows money.

In the opinion of the author, home generation is preferable in most mills of over 1,000 H.P., in view of (1) the necessity for heating the mill almost all the year round; (2) the cheapness of coal in mill districts; (3) the favourable capital and running charges obtainable in the mill. Some engineers place the critical horse-power as low as 250 H.P., but this appears unwarrantable.

Attempts have been made from time to time to determine the critical cost per unit at which imported energy becomes preferable to home generation. Such estimates are dependent on individual circumstances. The costs of home generation are frequently loaded with unjustifiable building, land and similar costs, and with too heavy attendance charges. On the other hand, insufficient allowance is often made for repairs and depreciation.

No doubt, in many cases, central stations can supply energy on terms favourable to themselves and to the millowner: this is evidenced by the fact that from 20 to 30 per cent. of the British mills do so obtain their energy. A large textile mill can generate its own electrical energy at from 0·35d. to 0·50d. per unit, and there are certain abstract advantages in a purchased supply which should be given a monetary value by somewhat raising the critical cost per unit above the actual cost of home generation. The critical cost per unit, charged by the central station, is given as ⅓d. by Bowman, ⅜d. by Booth and ½d. by Hill.

In the author's opinion, whenever a station is prepared to supply electrical energy at ½d. per unit, or less, the question of home *versus* outside generation requires very careful consideration.

Much more might be written on what must be a subject of absorbing interest to every engineer, apart from its interest to the general reader, as dealing with a staple national industry. In the former case the interest receives further stimulation from the fact that textile driving has opened a new and wide field for electrical enterprise.

Gratifying as this may be, the universal acclamation of the textile industry as the saviour of the electrical trade, an attitude taken up by certain enthusiasts, is to be deprecated as reflecting on its stability and status.

Honduras.—Concessions have been granted to J. W. Grace and to Manuel E. Lardizabel for the supply, to the towns of Puerto Cortez and Baracoa and of San Pedro-Sula respectively, of electrical energy for lighting and other purposes. Companies have been formed under the names of the "Puerto Cortez and Baracoa Electric Co.," and the "Empresa de Luz Electrica de San Pedro-Sula," to make use of these concessions.—*Board of Trade Journal.*

THE "PHASE ADVANCER" OF THE BRITISH WESTINGHOUSE CO.

Some 15 months ago Mr. Miles Walker read a paper before the Manchester Section of the I.E.E. on "The Improvement of Power Factor in Alternating Current Systems." After considering the subject in a general way, and describing the method proposed by M. Leblanc as long ago as 1895, and that put forward by Heyland in 1901, the author dealt with a device of his own, for which he suggested the title of "phase advancer."

On Thursday, March 31st, we were invited by the British Westinghouse Co., Ltd., of Trafford Park, Manchester, to see one of these machines in actual operation. This machine is the first that has been built, and is to be supplied to a customer in conjunction with a 900-KW. low-speed induction motor of the type illustrated in fig. 2.

The operation of the phase advancer during the tests proved conclusively that it was capable of doing all that was claimed for it.

A demonstration was given with the phase advancer running in conjunction with a 750-B.H.P., three-phase, 50-period, 2,000-volt, slip-ring induction motor, which constituted the motor end of one of two motor-generator sets which were run loaded back upon each other (as in the Hopkinson test), the speed of each being 590 R.P.M. The readings obtained were as follows :—

Reading.	Load on motor-generator. KW.	Volts on motor.	Power factor.	Speed of phase-advancer.	Remarks.
1	280	1,840	0·86 lagging	0	Phase advancer not running.
2	300	1,840	Unity	680	Phase advancer running.
3	375	2,200	„	700	Phase advancer running.
4	375	2,600	50 % leading	840	Speed increased.
5	20	2,000	5 % „	840	Load reduced.
6	550	2,600	80 % „	900	„ increased.
7	20	2,560	5 % „	900	„ reduced.
8	−312	2,600	40 % „	900	Motor running as generator.
9	0	2,560	5 % „	900	No load.

The voltage was regulated by hand to be constant for readings 1 and 2.

A comparison of readings 3 and 4 shows a rise in the generator voltage due to the phase advancer having substituted leading and magnetising for lagging and demagnetising currents.

An interesting feature of the test was that the generator which supplied current to the motor was not capable, without the phase advancer, of driving the motor at full load, as the power factor was then only about 90 per cent.; when, however, the phase advancer was brought into use and the power factor raised, the generator took the load easily.

As the magnitude of the lagging current in any circuit containing an induction motor depends on the amount of slip of the motor, it follows that the size of the phase advancer required for any given motor will depend on the slip of the motor, being larger where the slip is greater, and *vice versâ*.

The speed at which a phase advancer is run is not a matter of great importance, as any convenient speed will do.

One of the principal difficulties encountered in designing the phase advancer is that of keeping down the size, and therefore the cost of the commutator, as the currents to be carried are large.

The machine which we saw has a commutator only 9 in. diameter × 4 in. face, and nearly all the surface is covered by the brushes, as may be seen in fig. 1, there being no fewer than 12 sets of brushes, two to each pole.

Although the machine is designed to carry 1,200 amperes through the rotor, we were informed that, owing to the radiating action of a special device which has been employed on the end of the commutator, no undue heating takes place at this high current density. During the test the commutator was carrying some 600 amperes, yet at the finish we found it quite cool, almost cold in fact.

Below we give a brief description of the phase advancer and set forth the uses to which it may be put. A full explanation will be found in the I.E.E. *Journal*, Vol. 42, page 599. There is no doubt that it will supply a long-felt want. In the form in which this machine has been developed by the Westinghouse Co., it makes a thoroughly practical article of reasonable size and cost, capable of doing all that is required of it under every-day conditions.

The phase-advancer may be regarded as an exciter connected in circuit with the rotor winding of an induction

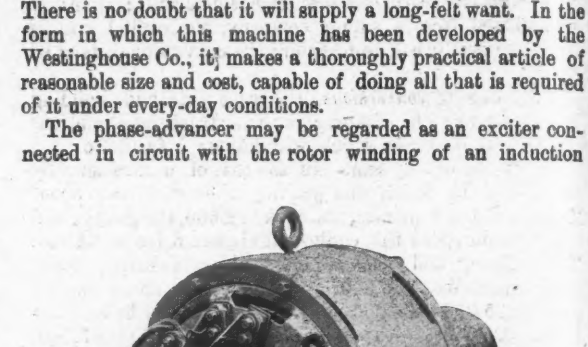


Fig. 1.—Westinghouse Phase-Advancer.

motor. It generates magnetising currents alternating at a low frequency (the frequency of the slip) and low voltage. If these magnetising currents are great enough to create the magnetic flux in the motor, the latter will run at unity

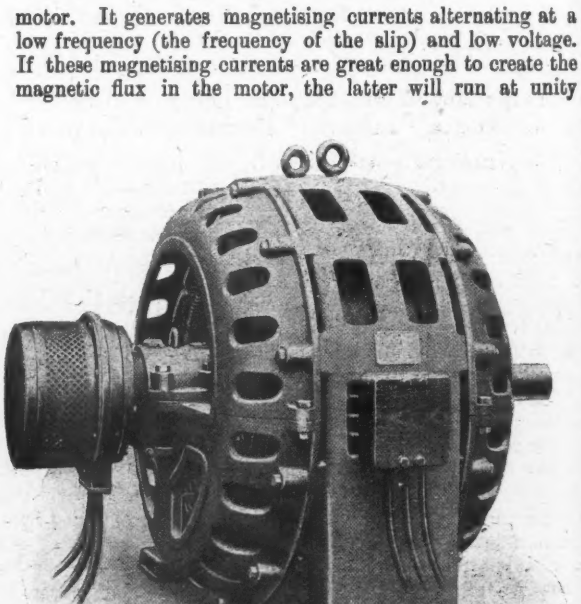


Fig. 2.—Westinghouse Slip-ring Induction Motor.

power factor. If they are greater than are necessary to create the flux, then the motor will run on a leading power factor.

In order that the current in the rotor may exercise a magnetising effect, it must lead in phase on the E.M.F. generated by the rotor slip. To get a leading current, it is necessary to introduce a leading E.M.F. This leading E.M.F. is generated by means of an armature somewhat similar to a direct-current armature, revolving in a magnetic field which is excited by a leading current. The leading exciting current

is obtained by using the current in one phase to excite the field coils and produce flux which generates E.M.F. in another phase.

The motor is started up on a rheostat in the ordinary way, and the only extra switchgear required is a three-pole knife switch for throwing in the advancer. If the advancer should break down (a very unlikely accident with a machine operating at 20 volts) it can be cut out, and the motor then operates just as it would have done if the advancer had not been installed. The commutation is perfect, and the commutator keeps quite cool, so that the machine will run for many months without any attention being paid to the carbon brushes. The peripheral speed of the commutator being only 2,500 ft. per minute, the wear of the brushes is exceedingly small, and the commutator takes a bright polish.

Taking a slip-ring induction motor with a power factor of about 92 per cent. on full load, it is possible by means of the phase advancer to alter this, so that instead of taking a lagging current the motor may run at unity power factor, or even be caused to take a leading current up to 30 or 40 per cent. power factor, so as to compensate for lagging current taken by other motors, &c., in the system.

Under these circumstances, the amount of idle power required for magnetising is only a small fraction of that required when the magnetising current is supplied at the full frequency and full voltage in the stator winding.

This will be appreciated when it is considered that a 750-B.H.P. three-phase 50-period 2,000-volt 590-R.P.M. motor requires in the stator 50 amperes per phase as magnetising current, or an idle power of 175 K.V.A. When fitted with a 6-K.V.A. phase advancer, the same motor will run at unity power factor and require no idle power from the mains.

Another use for the phase advancer is in conjunction with induction motors under conditions where a large slip is required, such as for winding purposes or for driving rolling mills. This slip is at present obtained by inserting resistance in the rotor circuit, which means a large loss of energy. By means of the phase advancer, the slip required may be obtained and the power returned to the line instead of being wasted.

A further advantageous use for the phase advancer is in connection with induction generators. By means of the phase advancer an asynchronous generator can be built which will not only supply its own magnetising current, but can supply wattless currents to other parts of the system.

Such machines should be particularly useful where it is intended to feed power into a system of mains, as from a waste-heat station or from a small isolated water-power station, and where it is undesirable to connect a synchronous machine to the system.

Electricity in Country Districts.—The non-committal attitude of the Diet for the Rhine Province in regard to the establishment of works for supply to country districts, to which reference was made in this journal on March 25th, has induced the five districts of Cleve, Geldern, Rees, Kempen and Mors to follow the example already set by other local authorities, and proceed with a scheme which has been under consideration for some time past for obtaining a connection with the Rhenish-Westphalian Electricity Works Co. Arrangements have now been made whereby the five districts will place at the disposal of the company, one-fourth of whose share capital is already held by other local authorities, a communal credit of a maximum of £350,000 for the erection of a central station, and each will also subscribe £25,000 in new shares, to be taken over at the price of 150 per cent. The interest on the credit will be 2 per cent., dating from the fifth working year, and will be increased according to the growth in the gross revenue. If the working of the station should result in a loss after the fifth year, the company is entitled to ask for compensation to the maximum amount of £37,500, which is to be obtained by adding the sum to the loan capital and sharing the same rate of interest as the latter. On the other hand, the Pomeranian Provincial Diet has just resolved to co-operate financially with the local authorities in the province in the establishment of four overland central stations to the extent of one-third of the cost of construction, and to raise a loan of £200,000 for the purpose. It is proposed to erect either three or four stations, and the Diet intends to form a special fund in connection with the management of the stations. The Diet has expressed the opinion that it is not the duty of the local authorities which are to be subsidised in this way to create a monopoly of contractors for the supply of machinery by the exclusion of the free competition of makers.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Publicity Literature.

I note that the printers of the Associated Electricity Supply Undertakings of London are not satisfied with the fact that I have a genuine quotation for advertising literature at a considerably lower price than the Undertakings are quoting to their country *confrères*, but also they now wish me to supply them with printed matter. I have, however, no desire to enter into competition with the London Supply Undertakings in selling printed matter—like the cobbler, it is better for me to stick to my own last. If the London Undertakings take the trouble to obtain competitive tenders, they will find that they would be able to get equally reasonable prices to those I have; but it does not follow, of course, that they should sell at those prices. My only reason for writing my original letter was to draw attention to the fact that the prices quoted were rather excessive. I am, however, pleased to note that, in spite of the high charges, and its incompleteness, the scheme has met with such success.

Central Station Man.

The Reason Why.

I am reliably informed that "the British Cable-Makers' Association are paying a number of German and other Continental cable-makers a subsidy in consideration of their refraining from competition in heavy cables in England and the Colonies."

You will observe the consideration is "cash," not a commercial *quid pro quo* of the ordinary nature. Does this account for the remarkably even figures which British makers quote for central-station requirements? and is it to be wondered at that some station engineers refuse to be fooled, and that they place their orders with the few foreign makers who have refused the bribe? The answer lies with the executive of the Cable-Makers' Association.

Kosmos.

[The suggestion put forward by "Kosmos" appears to us incredible, and we trust that a prompt denial will be forthcoming from the Association.—Eds. E.R.]

Ringing Bells Automatically.

Can any of your readers suggest a means for ringing a bell or a peal of bells automatically?—the mechanism preferably, perhaps, actuated by a small electric motor. It is desirable that the installation should not be too expensive.

Camp.

Sale of Scrap Metal.

Dealing with the above question, a correspondent in your last issue refers to my notes published some weeks back, but he does not seem to bear in mind that scrap metal only was dealt with by me. Short lengths of cable which can be used for odd jobs would always be dealt with in the manner he suggests; but short pieces of damaged cable, pieces cut off when jointing, &c., are usually retained until sufficient is in the stores to warrant a sale, or until such time as the market is favourable. I had in mind at the time of writing these scrap pieces, and the question raised was to what account should the cash received from the sale of such be allocated.

For example, say these odd lengths of cable, together with other pieces of old brass or copper and lead, had been collecting over a period of two years or so, and that they realised at the sale about £200. Now, my point was, To what account should that £200 be put: capital or revenue?

Your correspondent's statement that the question raised did not occur is wrong. More than one instance has been before me, and, as a matter of fact, at the time of writing a few months ago, a similar question was being debated in my office.

Interested.

London, W., *April 12th*, 1910.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Governors for the City of Winnipeg Turbines.

One of the factors which has rather deterred English engineering firms from doing business in Canada has been the belief that Canadians would always purchase in the cheapest market—represented in English minds by America—regardless of the quality of the machinery they were paying for. A rather striking contradiction of this belief is found in the Toronto *Contractors' Record* for March 9th, 1910, reading:—

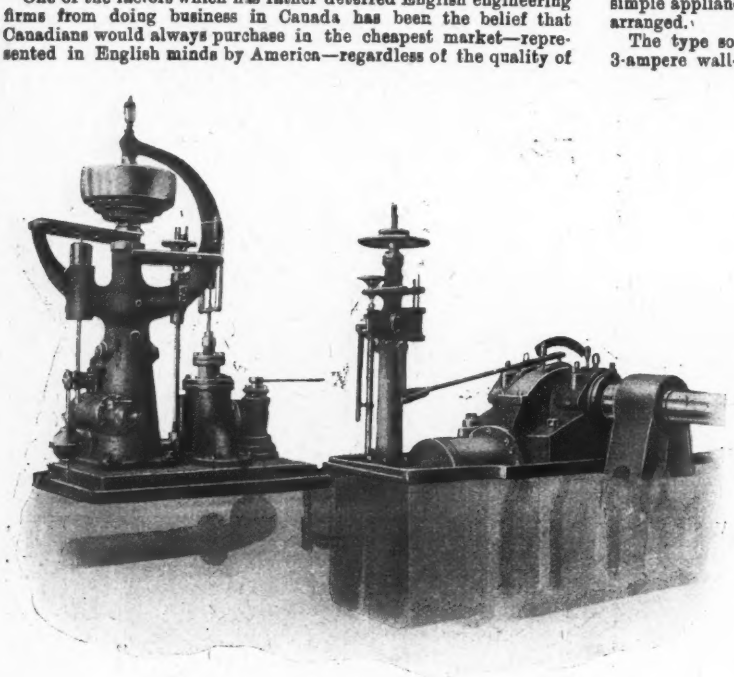


Fig. 1.—Boving Governor for 12,500 h.p. Water Turbine.

"Winnipeg, Man.

"The tender of the Jens Orten-Böving Co., of London, Eng., for the supply of seven turbine governors for the power plant was accepted at $23,000. Two other tenders were received, as follows: Ludlow Valve Manufacturing Co., Troy, N.Y., $12,200; Lombard Governor Co., Ashland, Mass., $18,000. The tender of Glenfield & Kennedy, Kilmarnock, Scotland, for the supply of five foot-valves for the power plant was accepted at $2,852."

Although a part of the difference of $5,000 which the city authorities are willing to pay for their governors may be accounted for by the fact that Messrs Böving & Co. are supplying the turbines, yet the Lombard governors are so well known and so popular in the Canadian market, that this fact cannot account for the whole difference.

We are inclined to believe that even in this country the $18,000 tender would have been accepted, but Böving & Co.'s governors have been in such successful operation in plants such as at Trolhättän, where there are four connected to units of 12,500 h.p. (one being shown in fig. 1), and the consulting engineers to the city of Winnipeg were so strongly convinced of the superiority of the Böving governor over the Lombard, that the Winnipeg Council were not afraid to sanction an expenditure of an extra $5,000.

The contract is not a large one, but it clearly points out that in Canada price is not everything, provided the right man is on the spot to point out the superiority of more expensive machinery.

It is interesting to note that Messrs. Böving are also supplying two similar governors for 3,750-h.p. units and a repeat-order 6,000-h.p. water turbine for the Calgary Power and Transmission Co., and four governors for 2,750-h.p. turbines for the Mines Power Co, Tenisskaning.

Illuminated Elevator Threshold.

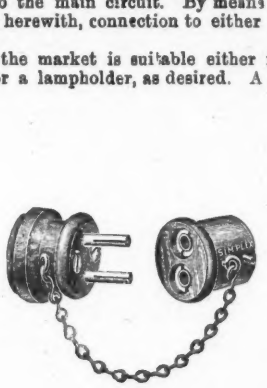
The manager of a large office-building has devised an illuminated elevator threshold which indicates to one entering the car the exact position of the elevator floor, thus avoiding the danger of injury from stumbling or falling when the elevator is not in alignment with the floor of the storey at which the car is stopped. The device consists of a cast-metal plate containing glass lenses in both its upper and outer surfaces, which are illuminated by two bung-hole type incandescent lamps contained inside the hollow box.

Many accidents in elevators happen through carelessness on the part of the operator or passenger when entering the car, and it is believed that this simple apparatus will provide a safeguard against them.—*Electrical World.*

Combined Wall-Plug and Lampholder Adapter.

Messrs. Simplex Conduits, Ltd., have introduced a novel form of combined wall-plug and adapter, which is suitable for use in connection with electric table standards, floor standards, kettles, irons, and so on. A considerable difficulty has been experienced by the contractor, in the sale of the before-mentioned, as to whether his client requires a two-pin wall-plug or a lampholder adapter for connecting his apparatus to the main circuit. By means of the simple appliance illustrated herewith, connection to either can be arranged.

The type so far put on the market is suitable either for the 3-ampere wall-socket or for a lampholder, as desired. A further type, suitable for 5-ampere wall-sockets, is at present in course of development; this pattern can be used either with a lampholder or wall-socket, and is made in two halves, the two parts being attached together by means of a stout brass chain, so that there is no possibility of that portion which is not in use being lost.



Figs. 2 and 3.—Simplex Combined Wall Plug Adapter.

The price at which this accessory is sold is very low, and compares favourably with the accepted market price for an ordinary wood lampholder adapter. Full particulars are contained in one of the recent publications of the firm.

The S.M. Electro-Magnetic Drive for Planing Machines.

Some time ago we briefly referred to the above magnetic-clutch drive for planing machines, which was introduced from Austria, where it has been in use for some time with great success. Licences to manufacture have been granted to various Continental firms and to Messrs C. E. Lugard & Co., of Chester, and some 10,000 h.p. of the clutches have been supplied for various purposes.

Many engineering works have in their shops what is now considered an old planing machine, built perhaps 10 or 15 years ago, but strong and capable of doing good work. Such a machine, cutting at 25 ft. per minute, resting for 3½ seconds for the belt to come over, and returning at 35 ft. per minute, if fitted with a magnetic drive, can be speeded up without any damage to the machine, to give two cutting speeds of, say, 28 ft. per minute for cast-iron and and 50 ft. per minute for steel or brass, with no appreciable rest at the end of the stroke, and a return speed of 100 ft. per minute or more, thus giving at least 2½ times its former output. The conversion is carried out by replacing the shaft carrying the three belt pulleys and the quick-return sleeve and pinion, by a shaft carrying a double S.M. electro-magnetic clutch fitted with pulleys. The old

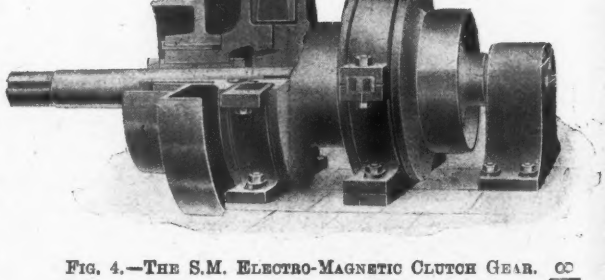


Fig. 4.—The S.M. Electro-Magnetic Clutch Gear.

striking gear, which accounted for 90 per cent. of the former breakdowns, is done away with and replaced by a two-way switch.

The electrical connections consist of a D.P. switch and two S.P. fuses for connection to the shop mains, and a pear switch with flexible, for remote control of the table if such is desired.

We illustrate in fig. 4 an S.M. electro-magnetic reversing shaft, fitted for two cutting speeds and a constant return speed. The clutches each consist of a stationary magnetic body containing a coil, a divided armature, one part running loose on the shaft between two collars and carrying the pulley, the other part secured by a feather on the shaft, but capable of sliding endways, fitted with a renewable cone of hard fibre. As soon as the circuit is closed, the two parts of the armature are sucked together by magnetic attraction, the drive being partly magnetic and partly frictional.

An air-gap is always maintained between the stationary magnetic body and the revolving armatures, also the two parts of the armature only engage through the medium of a non-magnetic body, so that sticking from residual magnetism is impossible.

The chief advantages claimed for this system are:—

1. No shifting belts.
2. Constant speed for any length of cut.
3. Accurate reversal.
4. Simplicity of apparatus and electrical gear.

It will be noticed that, owing to the use of a stationary magnet, no slip-rings or brushes are required, and the drive can be installed as well from existing line shafting as a motor.

Three methods are put forward of utilising the drive: an open and cross belt direct from the line shafting, the clutch shaft being connected direct to the planer; open and cross belt, the clutch being mounted on a countershaft and connected to the belt pulley of the planer by a short belt; and a gearing drive through the ordinary five-wheel change gear connected direct to the planer and motor. It must not be supposed that the system is only applicable to old machines; new planers have been fitted, and the cost is much below that of the usual electrical drive.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"C. S. M." writes:—"It is a very general practice among electrical central station people to supply two houses from one service cable, and to have a cut-out specially arranged to take a supply from the live side for the second house. The cable or wire is taken from the special cut-out to another through the party wall. I have just met with a case where permission to take a supply from a cut-out in one cellar to the adjoining one, given verbally, has been followed by a demand for an acknowledgment payment annually, and should like your views on the position.

"Of course, the law provides for the cost of service cables, &c., inside the building line being paid for, and becoming the property of, the consumer; but in ours, as in most other undertakings, no charge is made for the service up to the meter."

*** It is presumed that, in the present case, the demand for an acknowledgment is made by the owner of the first house. It seems that he has a perfect right to demand an acknowledgment, because there can be no doubt that it is a technical trespass to lay wires on any part of a man's land. One has to consider what would be the position; suppose this main were allowed to remain *in situ* running through the party wall for 20 years. By that time a prescriptive right to have it left might be acquired, and the landlord of the first house would have something to say in the matter. It is difficult to see why there should be any objection made to paying a "peppercorn" rent.

ENGINEERING EDUCATION IN GERMANY.

The labour market for technically educated men appears to be largely over-crowded in Germany, more so, in fact, than in the United Kingdom, and those engaged in industrial work in the former country, declare that the market has actually possessed a superabundance of supply over the demand for quite a number of years past. On the one hand, the explanation for this state of affairs is afforded by the circumstance that many firms make a practice of systematically improving pupils in their technical departments, either with or without attendance at evening courses of instruction, with the object of developing them into practical technical men for work in future years. On the other hand, the technical schools play a very prominent part in contributing towards the excess of highly trained workers. It will, perhaps, surprise many to learn that according to statistics prepared by Dosmar, in relation to the social movement of industrial officials in Germany in 1909, there are no fewer than 31 State technical schools for machine construction and electrical engineering in that country; 44 State schools for the building trades; 28 State schools for technical improvement in other trades; 37 municipal and private schools for machine construction and electrical engineering; 14 municipal and private schools for the building trades; and 22 municipal and private technical schools for various trades. These do not include improvement schools, instruction by correspondence, &c. These figures have just been set forth by Herr A. Thimm, of Charlottenburg, who points out that a closer examination of the Dosmar tables conveys the impression that the statistics mentioned do not exhaust the number of schools, and that as a consequence the number of students, which is shown in the tables to exceed 26,000, must be still further considerably increased. In addition there are nine technical high schools in Germany, whilst a tenth will shortly be opened at Breslau.

The position of affairs at present is such, according to Herr Thimm, that the number of university educated engineers needed by industrial works is proportionately much smaller than those passing through the secondary and trade schools, and it therefore follows that only a small portion of the university men find suitable employment in practical work. What becomes of the remainder? We are told that they are compelled to accept subordinate work which the less well-educated men are able to perform just as well, and probably better. In these circumstances, the forthcoming activity of the Breslau technical high school is regarded with some concern in interested circles. The result of the overcrowding of the market is that, in order to secure employment, technical workers underbid one another in their offers of services, and salaries have consequently declined. So much is this so, that at times, particularly in periods of general economic depression, salaries have receded to such a low level as to lead to an enormous amount of poverty and despair, and many are unable to obtain any employment at all. It is only necessary to scan the advertisements in the trade journals during a term of unfavourable trade in order to secure convincing proof of the confusion in the labour market. Even to-day, when the condition of trade has improved in recent months, advertisements appear in the trade journals for technical men or engineers at the princely salary of 30s. per month, whilst other advertisements, even from university educated men, offer the payment of a lump sum or several months' salary to those who will provide the advertisers with a suitable position. The superabundance of labour has the further effect of bringing about contracts with employers which are declared to be harsh and unjust to the technical men or engineers, who are frequently required to place their services without limit at the disposal of the employers, to work overtime without extra remuneration, and to refrain from engaging in any other work, whilst at the same time unreasonable clauses as to entering the employment of competitors are sought to be enforced.

The overcrowding of the profession has been pointed out by interested circles for years past, but the only result so far has been a slight reduction in the number of students at the technical high schools, although this decrease will, presumably, be more than counterbalanced when the new school at Breslau has been opened. The owners of private technical schools also assist in swelling the ranks of the trained men, and one school alone is reported to expend £4,000 per annum abroad in advertising its capabilities. The result of this is that hundreds of foreigners, particularly Russians, attend the schools, and when fully qualified they decide to remain in Germany and further increase the number of applicants for employment. As it has been found impossible to deal with this evil, the organisations maintained by technical officials have sought to help themselves in another way. In the first place, the Federation of Technical Officials introduced a system of unemployed aid at the beginning of 1906, and the German Technicians' Union followed this example in 1908. The object of the pecuniary aid, which the federation largely increased during the critical year of 1908, is to afford

support to the members when confronted with unfavourable conditions sought to be imposed by employers, and it is considered that this action has doubtless arrested the further decline in salaries in the social contest; but it has not been able to prevent the payment of salaries which are said, having regard to the large increase in the cost of the necessaries of life owing to the Imperial Customs policy, to be inadequate for existence. The organisations of the technical officials now propose to seek a remedy by the endeavour to secure a minimum basis of salaries. The question has been discussed theoretically since 1907, and has just engaged the attention of the Federation Conference held in Berlin. In addition to this, an active propaganda has been embarked upon in connection with the students at the numerous technical schools throughout the country. In this way the students are being enlightened as to their ideal and material interests, and if the scheme is successful, Herr Thimm considers that the successful carrying through of the minimum-salary programme in industrial establishments will be accomplished within a reasonable period. The fact is, however, overlooked in this connection that, whilst a large number may be gained over to the idea of a minimum remuneration, there will still be a considerable number of qualified men who will either be ready or compelled by necessity to accept any positions which may be offered to them; that trade unionism is always more difficult to carry on among officials than among ordinary workmen; and that the opening of the Breslau technical high school promises to result in an increase rather than in a decrease of trained men in the future.

BUSINESS NOTES.

Catalogues and Lists. — The Westinghouse Cooper-Hewitt Co., Ltd., 151-2, Great Saffron Hill, London, E.C.—List No. 8, illustrating and describing the Westinghouse water steriliser for D.C. circuits, its installation and operation.

The Appleby Crane and Transporter Co., Ltd., 58, Victoria Street, Westminster, S.W.—Twenty-eight-page finely illustrated catalogue of their hand-jib cranes. A separate 8-page publication gives a schedule of prices of these cranes.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Copies of the March and April supplements to the firm's catalogue of vulcanised india-rubber wires and cables: The March list relating to bell wires and bell flexible cord, that for April dealing with motor-car leads, the prices of which have been raised owing to the high price of rubber.

New issue (April, 1910) of their Catalogue No. 37, dealing with "Dry Cells and Dry Cell Batteries," which supersedes the August, 1909, issue. It differs from the latter in certain minor respects, and ignition coils, specially suitable for use with Siemens Obach dry batteries, have been added.

The Electric Construction Co., Ltd., 9, New Broad Street, London, E.C.—We have received a bound copy of this company's price lists, in which numerous additions and revisions have been made since the issue of January, 1909, was received. The volume will be of great assistance to plant and machinery buyers and specifiers, who desire to have at hand a complete record of the firm's various classes of manufactures, with prices, code-words, dimensions, shipping particulars, &c. Ball-bearing continuous-current motors and generators, A.C. motors (two or three-phase, 50-period, induction); a number of lines of switchgear (rotor starters, auto-transformer starters and panels, oil type circuit-breakers and main switches, quick-break knife switches, A.C. star mesh starters, porcelain handle fuses and field regulators; also electric haulage gears, electro-magnets, leather belting and petrol-electric sets; the mere recital of these main heads will indicate the wide range covered in the lists.

The Peckham Truck Co., Queen Anne's Chambers, Westminster, S.W.—Catalogue containing many drawings showing their "new" Peckham system of gears and trucks for tramways and high-speed electric and steam railways, embodying improvements which have been tested under severe conditions for over two years.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflet showing by photographic reproductions the making of a torsion sleeve point for aluminium transmission lines, and giving a table of diameters, resistances and weights of H.D. aluminium and copper cables respectively.

The Edison and Swan United Electric Light Co., Ltd., 36 and 37, Queen Street, E.C.—Three new leaflets, as follows:—Nos. E, 2,176, giving particulars and prices of "Ediswan" enclosed arc lamps and accessories; A 2,181, relating to combined switch sockets and plugs; and I 2,187, devoted to moving iron-type instruments.

The Holophane Co., 12, Carteret Street, Westminster, S.W.—New six-page catalogue (No. 3) describing and giving prices and illustrations of their Holophane arcs designed especially for use with metallic-filament lamps. A page of "Spacing Rules" for general illumination is given.

Messrs. A. P. Lundberg & Sons, 477-487, Liverpool Road, London, N.—Six-page well illustrated publication (No. S 23) in the firm's standard form, describing and giving prices of their "adaptable combination," consisting of a block of glazed porcelain arranged with three suitable recesses to take their standard types of switches, wall connections, bell pushes, &c., as set forth in the list.

Messrs. Wright & Wood, Ltd., Century Works, Halifax.—New price lists, Nos. 26 to 29 inclusive, have just been issued. These give fully tabulated particulars, prices, dimensions and weights of continuous-current motors and dynamos up to about 100 H.P., half hour rated crane motors, two and three-phase induction motors, single-phase motors (squirrel-cage and slipping types), also a boot polishing electric motor which is made in two sizes, ¼ and ½ H.P.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Specimens of three small advertisement cards now being issued have been received. One shows a water boiler and a combined electric grill; another an electric hot pad and a bed warmer; and a third a convenient nickel-plated electric toaster with which your bread can be toasted on the breakfast table while you wait.

Messrs. Greenwood & Batley, Ltd., Albion Works, Leeds.—Two new catalogues are just being issued by this firm. No. 9 consists of between 60 and 70 pages, and contains specification of their "Leeds" standard continuous-current motors, semi-enclosed, ventilated enclosed and totally enclosed types from 1 to 200 H.P. Tabular information as to outputs, dimensions, shipping weights and measurements, and prices, occupy many pages, which are followed by excellent half-tone illustrations of the motors and their application to the driving of pumps, winches, blower fans, bolt and nut making machines, &c. No. 10 catalogue (between 40 and 50 pages) deals in a similar manner with the "Leeds" continuous-current dynamos for from 1 to 150 KW.

Messrs. Venner & Co., 6, Old Queen Street, Westminster, S.W.—Leaflet illustrating, describing and pricing, their "Venner" time switches.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—Catalogue No. 18 (44 pages) containing illustrated particulars and tabulated prices and dimensions of their various switches, including "Acme" patent switches, quick-break knife switches, double-pole iron-clad switches, voltmeter switches, field switches, junction pieces, &c.

The Wilson Wolf Engineering Co., Ltd., Thornton Road, Bradford.—Advance copy of Section VI of their new catalogue dealing with "Arctic" D.C. propeller ventilating fans. Prices are given for a complete range of fans up to 72 in. diameter, together with suitable regulators and other accessories. We illustrated one of these fans on page 546 of our last issue. A section is in preparation dealing with A.C. fans of a similar type.

Messrs. E. Goossens, Pope & Co, Ltd., 5, Arthur Street, New Oxford Street, London, W.C.—New 16-page catalogue giving full size illustrations and reduced prices of their metallic-filament lamps.

America on the Scent.—An American Consul in Australasia has reported home stating that a company has been organised in his district for the development of certain local water powers to be used in metallurgical works. "It is estimated that the cost of the water-power plant will be $729,975. The company also expects to sell to a neighbouring municipality power for use in lighting, street-car service, &c., and, as fast as business warrants, additional installations of machinery and equipment will be made. American manufacturers of electrical, hydraulic, and metallurgical machinery who may desire to secure business orders in connection with this development can obtain the name of the company, together with further details embodied in a confidential circular, upon application to the Bureau of Manufactures. The Consul states that there will be time for American manufacturers to communicate with this company, as details of construction will probably not be arranged before six months at least, or until the financing of the construction has been arranged for in London."

Here we are again!

"A report from an American Consular Officer in Eastern Europe encloses a prospectus of a proposed electric railway between two cities in that region. A concession will be granted for the building of the road, a distance of nearly 47 miles, at an estimated cost of $3,200,000. This is a favourable opportunity for American capitalists who are looking for investments in foreign countries. The prospectus is filed in the Bureau of Manufactures, and the Consular Officer writes that if further information is desired, inquiries addressed to him will be given prompt attention."

Osrams for Liner Lighting.—One of the White Star liners, upon which Osram lamps are fitted throughout, recently returned to port after five months' cruise, and the engineer's report states that only one lamp has failed throughout the whole period of absence, although the average life of the lamps in question is already over 700 hours. This liner is now leaving for another cruise with identically the same lamps, and only half the usual number of spares are being taken on account of the present perfect condition of the lamps now installed, and the satisfactory results on the last voyage.

Bankruptcy Proceedings.—W. Rae.—A sitting of the London Bankruptcy Court was appointed to be held on Friday, April 8th, for the public examination of Wilson Rae, formerly known as Kenderdene Crole Rae and as Wm. Rae, electrical therapeutic specialist, lately carrying on business at 43-4, New Bond Street, W., in his own name and as the Rae Electric Light Cure Hydro. Upon the case being called, Mr. Walter Bayle, Assistant Official Receiver, reported that the debtor was serving a term of 15 months' imprisonment in the second division for larceny and bigamy. Under those circumstances he asked for the sitting to be adjourned *sine die*. His Honour made an order on those terms.

H. K. P. Barham (South of England Electrical Engineering Co.), electrical engineer, Fratton Road, Portsmouth.—Receiving order made April 4th on debtor's own petition. First meeting, April 21st; public examination, April 25th; both at Portsmouth.

T. L. Callender (Shamrock Cycle Co.), electrical engineer, Nottingham (late of St. Helier's, Jersey).—April 28th is the last day for receipt of proofs for intended dividend by E. W. Humphreys, 4, Castle Place, Nottingham, the Official Receiver.

W. H. Palmer, electrician, 10, Great Castle Street, Oxford Street, London.—Receiving order made on creditor's petition, April 6th.

Wycliffe Galland Everingham, electrician, 37, Auckland Road, Ilford, Essex.—This debtor attended at the Shire Hall, Chelmsford, last week, for his public examination before Mr. Deputy Registrar Duffield, on a deficiency of £594. In reply to questions, the debtor said he commenced business in 1906, and he attributed his failure to want of experience. The examination was adjourned.

Wilfred Herbert Durrant, electrical engineer, 53, Tonning Street, Lowestoft, Suffolk.—The first meeting of creditors herein was held last week at the Official Receiver's office, 8, King Street, Norwich. The statement of affairs disclosed liabilities expected to rank for dividend £89, and assets £17, there being thus a deficiency of £72. It transpired that the debtor commenced business in August, 1906, with £15 capital. In March, 1907, a Mr. Parish joined him in partnership, which was dissolved in December, 1908, Mr. Parish taking over the liabilities and assets. In the following month the debtor took into partnership a Mr. Bird, and traded under the style of Bird & Durrant, but this partnership was also dissolved the following September, when Mr. Bird took over the assets, and paid the liabilities. Neither of the dissolutions were gazetted. The books of account kept comprised a customers' ledger, a cash sales book, and accounts paid, and a stock book. Part of the debtor's household furniture is claimed by his wife, and the remainder is on the hire-purchase system. The failure was attributed to competition, want of capital and ill-health. No resolutions were passed, and the matter was left in the hands of the Official Receiver, who will deal with the estate in the usual way.

Alan McAlpin (trading as McAlpin & Co.), electrical engineer, 44, Cank Street, Leicester, and Cumbergate, Peterborough.—This debtor attended at the Castle, Leicester, last week for his adjourned public examination on a deficiency of £804. The Official Receiver stated that the examination had been previously adjourned in order that the trustee, who had only just been appointed, might have an opportunity of looking into the matter. Asked by the Official Receiver how he had lost money on contracts, the debtor said that the estimating was wrong, he having given prices which had resulted in a loss. He was then taken through a balance-sheet which was got out at the end of three years' trading, and which showed a good profit. He said that all the losses had been since 1904. The debtor said he thought he would have been able to pull round. He had received over £2,000 since the 1907 balance-sheet, and that had all gone, together with about £800 of creditors' money; he explained, however, that some was used to pay a loan of £1,000, and he had also paid the bank. He did not realise his position until he had the books audited about a month ago. He said that the books had not been well kept; and as he was out of town a good deal superintending the branch at Peterborough, he had been unable to look after the clerks. There were 18 judgment creditors against the debtor at the time of his suspension, 11 others owing, and, in addition, he had paid out several executions within the last 18 months. After the debtor had been questioned by Mr. Barradale, a creditor named Jopling, and Mr. Simpson, who appeared for the debtor, the examination was concluded subject to the signing of the shorthand notes.

William Charles Ellis, electrician, Applegate Street, Leicester.—This debtor attended at the Castle, Leicester, last week for his public examination on a deficiency of £187. In reply to questions, the debtor said he started business on his own account last year without capital, and had lost money on several of his chief contracts. The examination was closed.

Alfred Horswill Gibbings, engineer, 17, Gambier Terrace, Liverpool.—Mr. Registrar Howarth held a sitting at the Court House, Government Buildings, Victoria Street, Liverpool, for the public examination of the above debtor, on Monday last. The statement of affairs showed £2,784 of debts and £56 of assets. Mr. Cuthbert Smith, barrister, appeared for the debtor. Replying to the Official Receiver, the debtor said he had held successively the posts of electrical engineer to the Hove Commissioners, the Hull Corporation, and the Bradford Corporation. He had also been chief engineer to the South Lancashire Tramways Co., and the Stalybridge, Hyde and Dukinfield Tramways and Electricity Board. He commenced practice in Liverpool in February, 1906, as a civil and electrical engineer, and until June, 1907, was in partnership with a Mr. Chantler. In May, 1908, he made an agreement with the North British Electrical Power Syndicate, Ltd., by which he was to act as consulting engineer in regard to some proposed works for the distribution of electrical energy in Scotland, from which very lucrative results were anticipated, with the prospect of developments on similar lines in Lancashire and the North of England. The intended operations were stopped, however, by the passing of the Electric Lighting Act of 1909. He referred particularly to Sec. 23 of the Act, which, he said, had been inserted by the House of Lords on the third reading of the Bill without any intimation or publicity being given. The consequence was that the syndicate could not proceed without obtaining a provisional order, the cost of which, and the opposition to be expected, and restrictions that would probably be imposed, placed it out of the power of the syndicate to proceed. His agreement with them was, therefore, terminated, and a scheme which he had in hand in Yorkshire was similarly frustrated. He attributed his failure entirely to the Act in question. The examination was adjourned in order that the debtor might furnish an amended deficiency account.

Condensing Plant.—The Mirrlees Watson Co., of Glasgow, have recently received a number of orders for steam condensing plant. These include five sets of surface-condensing plant for Messrs. Bolckow Vaughan's Steel Works, South Bank, working in connection with steam turbo-alternators and air compressors. They have already working in the same station four sets of similar plant, the total duty being equal to 350,000 lb. of steam per hour. Other orders include surface-condensing plant for Messrs. Stewarts & Lloyds; two sets, each of 60,000 lb. duty, for the Dominion Iron and Steel Co., per Mr. P. J. Mitchell; a barometric jet plant, with cooling tower and pipework, for Sir Wm. Arrol & Co.; a barometric plant for Messrs. Fyvie and Stewart, Melbourne; jet condensing plant for the Cadnow Colliery Co., per Messrs. G. Harland Bowden & Co.

Steel-Backed Ladders.—The demand for ladders of light weight to secure ease of portability is met by inserting in the backs of the wooden sides galvanised steel-strand wire, and Messrs. Heathman, of Parson's Green, S.W., the well-known ladder makers, have recently turned out some extension ladders to reach the height of 85 ft., and weighing only 2¾ cwt. They have made a large number of ladders for the Army Field Telegraph Service, and 50 of their telescopic ladder towers have been delivered to Woolwich Arsenal.

Dissolutions and Liquidations.—The Contraflo Condenser Co., Ltd., and The Contraflo Continental Patents, Co., Ltd.—These companies are winding up voluntarily, with Mr. W. S. Gregg, 3 and 5, Crown Court, E.C., as liquidator, and a new company is to be formed under the title, the Contraflo Condenser and Kinetic Air Pump Co., Ltd.

R. A. Dunt & Co., electrical engineers, 91, High Street, Southampton.—Messrs. E. N. Bedells and R. A. Dunt have dissolved partnership. Debts will be attended to by Mr. Bedells, who will continue the business as E. N. Bedells & Co., at 83, Above Bar, Southampton.

Thomson-Knox Co., mechanical and electrical engineers, &c., 10-12, Scrutton Street, Finsbury, E.C., also Manchester and Glasgow.—Messrs. W. T. Thomson, J. and C. N. Knox, and W. B. Macdonald have dissolved partnership. In future Mr. W. T. Thomson will continue the Scotch and Irish business, the English business being carried on by Mr. J. Knox, who will attend to English debts of the late firm.

American Attentions to Turkey.—Following on our treatment of the matter in a leading article this week, we are interested to note that in a recent American Consular report on Turkey, the writer says: "Everything is yet to be done in this country, and we should find (if we had an American Bank or agency) opportunities for capital in railways, electric lighting and traction, harbour works, irrigation, &c. The thin end of the wedge would be the establishment of a branch of an American Bank."

D.P. Batteries.—The Leek District Council and the Letchworth Garden City having found it necessary to enlarge their plant to cope with the increasing demands for current, decided as an economical measure upon adopting larger storage batteries, and have again placed their orders with the D.P. Battery Co., Ltd.

Trade Announcements.—The Lancashire Electrical Engineering Co., Ltd., of Ashton-under-Lyne, Manchester, established 1885, desire us to state that they are not in any way connected with a firm of a similar name recently started in Manchester.

Mr. Bernard Bleasdale (late of Messrs. Platt & Bleasdale, Victoria Square, Bolton) has taken premises at 106, Deansgate, Bolton, and will shortly commence business as an electrical engineer, with special plant for electro and copper plating.

Siemens Bros. Dynamo Works, Ltd., supplies department, 39, Upper Thames Street, E.C., have, owing to the increasing business, found it necessary to provide extra telephone facilities. They have now four lines, London Wall 8,270, instead of London Wall 6,520.

With reference to the recently-announced amalgamation of Arthur Koppel with Messrs. Orenstein & Koppel, it is stated that the amalgamation of the various interests in different parts of the world has been completed, and the full title of the firm now adopted is Orenstein & Koppel-Arthur Koppel (amalgamated). The total number of workmen and office staff employed by the firm exceeds 6,000.

The British Westinghouse Electric and Manufacturing Co. advise us that their supply department (offices, showrooms and stores) for the London district has been removed from 27, Chancery Lane, W.C., to larger premises at 3, West Street, and 30, Litchfield

Street, Charing Cross Road, W.C., where they will be pleased to show the Westinghouse-Bremer patent "Arcturus" flame arc lamps, various forms of enclosed arc lamps, their latest magazine flame lamps for street lighting, and to demonstrate the saving to be effected by the Westinghouse patent "Auriga" metal-filament lamps.

Book Notices.—*Garcke's Manual of Electrical Undertakings.* Vol. XIV. London: Electrical Press, Ltd. 21s. net.—In taking up this book one is beset with two dangers. It is not a volume that can be reviewed as one would a technical or philosophical treatise or a piece of fiction, yet the electrical writer finds in it so much that he might write about without actually reviewing, that the difficulty would be to know when and where to leave off. Having, then, dismissed the idea of dealing with the contents in any detail, one is in danger of going to the opposite extreme, and being satisfied with just telling the reader that "Garcke's Manual is out." But that would be hardly fair treatment, for there are changing features of more or less importance and value, introduced with each successive edition of a book of this kind. So far as the classification of the 3,000 electrical undertakings particularised in it is concerned, this remains as it was, namely:—(1) Electric Lighting, Power and Traction; (2) Telegraphs and Telephones; (3) Manufacturing and Miscellaneous; (4) Colonial and British Possessions; (5) Directories of Officials, of members of electric lighting and tramway committees, and of electrical contractors; (6) Index of undertakings and list of other electrical undertakings registered since 1896. It is in (5) that the chief difference appears this year. The list of members of electric lighting and tramway committees has been considerably amplified. A list of electrical contractors is now published for the first time. The list is arranged under the heading of the town in which the contractors' premises are situate, the various towns being put in alphabetical order after London. Where possible the year upon which the business was established is given. The Directory of Officials contains 12,000 names. In one of the sections there is again a general survey of the year, relating to provisional orders, profits on electricity supply, &c. But here our notice must end, as the crowded state of our pages this week will not permit us even to enumerate the many other subjects that are covered in this book.

Leake's Register of Industrial Plant and Introductory Notes. By P. D. Leake, F.C.A. London: H. Good & Son. Price 5s.—We have on numerous previous occasions dwelt upon the ever increasing importance of a systematic and sufficient provision for depreciation for the purpose of coping with renewals as they arise, so that each year's trading may as far as possible bear its due proportion of the loss. For depreciation is a loss which forms a charge in the profit and loss account before arriving at the net profit. Adequate provision for the restoration of wasting assets is one of the paramount essentials in all industrial undertakings. The precise mode of arriving at that adequacy, as a general statement, is a matter of opinion based upon a consideration of the prevailing conditions and circumstances of the case under review. In practice, however, the sum proposed to be so allocated is not infrequently governed by, or contingent upon, the amount of the credit balance of the revenue account. Mr. Leake's Register, which consists of loose leaves with printed headings for the classification of capital outlay, and the measurement of depreciation, either monthly or yearly, by means of a regular record of expired values, based on estimates and revised estimates of the useful life of each class of plant, is well designed, and the notes, which are printed separately in pamphlet form, are lucid, and serve to explain the use of the Register. We are, however, inclined to the view that most industrial concerns prefer to draft their own forms to suit the varying details of their particular requirements, though even in that event the Register and Notes thereon may be consulted with advantage. The Register, when in use, is, of course, independent of, but supplemental to, the ordinary books of account, and will contain a complete and interesting record of the details of the amount periodically marshalled in the profit and loss account under the designation of depreciation. The price seems high.

"The Principles and Practice of Ironfounding." By E. L. Rhead. 1910. Manchester: The Scientific Publishing Co. Price 7s. 6d. net.

"Abnormal Places." Coal Trade Pamphlets, No. 4. London: The *Colliery Guardian*. Price 1d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXIX, No. 4. April, 1910. New York: The Institute. Price $1.00.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. X, No. 3. 1910. Liége: The Association.

"*Bulletin* of the Société Belge d'Electriciens." March, 1910. Brussels: Ramlot Frères et Sœurs.

"The Post Office Electrical Engineers' Journal." Vol. III, Part 1. April, 1910. London: H. Alabaster, Gatehouse & Co. Price 1s.

"*Proceedings* of the Annual Convention of the American Institute of Architects." 1909. Washington: The Institute.

"Engineering Workshop Machines and Processes." By Dipl-Ing. F. Zur Nedden. Translated by J. A. Davenport. 1910. London: Constable & Co., Ltd. Price 6s. net.

"Foreign and Colonial Patent Laws." By W. C. Fairweather. 1910. London: Constable & Co., Ltd. Price 10s. 6d. net.

Leeds.—During 1909 the electrical department of the Leeds Industrial Co-operative Society, Ltd., turned out work of an estimated value of £2,222, the amount of wages paid during the year being £765.

For Sale.—Dundee Electricity Department invites tenders for six steel warren girders and six wrought-iron tanks. There are also over two tons of miscellaneous cover plates for disposal. Particulars from MR. H. RICHARDSON, the engineer.

An Office Companion.—From the GENERAL ELECTRIC CO., LTD., of Queen Victoria Street, E.C., we have received a very handy weapon for use on our office desk. It is of sufficient dimensions to warn our visitors concerning the length of their stay on Press days, and it will incidentally serve the ends for which a paper knife is usually employed. It never will get lost if we use

it as its thoughtful makers intend, for, as the illustration shows, it has a bell push in the end of the handle and a couple of yards of flexible cord. So that as we clutch our stiletto we can by secret pressure of the hand also summon the legions from below to our assistance. The idea is ingenious, and the article inexpensive.

Norwegian Customs Tariff Revision.—The Ministerial Council has just resolved to introduce a Bill to revise the Customs tariff as from July 1st, 1910. It is proposed to restrict the exemption from duty of electrical apparatus in group A to dynamos, motors and transformers.

Made in England.—Some idea of the extent to which "Osram" lamps are now being manufactured in this country may be gathered from the statement which has been received by us, certified by a City firm of chartered accountants, showing that the number of persons employed by the OSRAM LAMP WORKS, LTD., on March 30th, 1910, was, including staff and managers, 946.

Sweden.—The Aktiebolag Telotelefon is the name of a new company which has lately been formed in Stockholm with a capital of 1½ million kroner, to acquire and work the Egner-Hölmstrom patents.

"Onewatt" Lamps.—MESSRS. KRUPKA & JACOBY, of 11, Queen Victoria Street, E.C., inform us that they are in a position to offer Siemens "Onewatt" lamp with drawn tungsten filament giving 100 C.P. for high and low voltage. Higher candle-powers, namely, 200, 300, 400 and 600 will follow in rotation, the 200 C.P. being the first to make its appearance.

LIGHTING and POWER NOTES.

Asiatic Turkey.—According to the *Daily Mail* a venture for supplying the whole of Palestine with electricity for lighting, heating and cooking purposes, is being entered upon by a French company, which has its headquarters in Paris. Power will be supplied by the fall of the Jordan between the "Waters of Merom" and the Lake of Galilee, where the river descends 700 ft.

The generating plant will be erected on the west bank of the river, and it will be connected with all the chief towns of the country. Some £500,000 will be required for the initial expenses.

Australia.—Some interesting statistics from New South Wales show that during the ten years ending 1908 the electric light works in the State have increased from 33 of 2,779-H.P. capacity, with £129,027 worth of plant installed, to 97 of 46,200-H.P. capacity, with over a million pounds worth of plant. During the same period the gas works have fluctuated in number, starting with 38 with £426,145 worth of plant, and finishing in 1908 with 39, with £610,914 worth of plant installed, the make of gas being now less than double what it was ten years ago.

The Sydney Council's electrical undertaking returned a gross revenue of £118,275 and a net profit of £17,898, during the last municipal year. The engineer reports that a smaller profit is expected this year, but not under £12,000; he recommends the abolition from now, of meter rents, except where numerous meters are employed.

Various tenders have been received for the Pyrmont destructor, that of Messrs. Hughes & Stirling being favoured. The matter, however, according to our last information, was still being considered.

Bacup.—A L.G.B. inquiry was to be held yesterday into an application of the Corporation for sanction to borrow £3,000 for electric lighting and power purposes in the borough. The T.C. has agreed with Rawtenstall Corporation for the purchase of electricity from the latter, and the £3,000 is required for mains, meters, &c.

Bath.—The T.C. has agreed to the Electricity Committee's recommendation that certain clauses, inserted in the draft order relating to the proposed extension of the supply area, at the instance of the Bath Gas Co., should be objected to.

Barking.—The output of the Council's electricity plant for the year ending March 31st, 1910, was as follows, the figures for the preceding year being given in parenthesis: Units generated, 1,622,485 (1,583,713); units delivered, 1,374,960 (1,337,344); units used on traction, 293,712 (328,910). Seven oil street lamps are to be converted to electric incandescent lamps.

Birkenhead.—The question of reducing the price of electric current to the suburbs has been under discussion by the T.C., the proposal of the Electricity Committee being to charge the ordinary consumers for lighting purposes in Bidston, Upton and Prenton, 6d. per unit, instead of 7d. For the Committee it was pointed out that whereas the price had been reduced to users within the borough boundary with considerable success, its customers in the out-districts were paying 75 per cent. more than those inside. An amendment to reject the recommendation was submitted, on the grounds that the Council would be depriving itself of all the potential considerations when the extension of the borough boundaries came into practical form. The amendment was carried by 19 votes to 10.

Blackpool.—The following special tariff for energy for electrical signs has been adopted:—External signs of 500 watts capacity and upwards, a flat rate of 2d. per unit except during July, August and September, when the charge will be 3d.

Boston.—The T.C. has received a notification from Messrs. Crompton to the effect that they have withdrawn their notice of application for a prov. order under the E.L. Acts.

Canterbury.—The T.C. has decided to defend a threatened action by a London firm who claim £25 13s. 3d. in respect to free wiring rentals.

Continental Notes.—Italy.—It is reported from Milan that a company has been formed at Belluno, with the co-operation of the Southern Railway Co., and two hydro-electric companies in Venetia, for the purpose of utilising the water power of the Boite, which is a tributary of the Piave, and which is to yield 20,000 H.P. In addition to the intention to supply power to a number of industrial works in the Piave valley, it is proposed eventually to furnish power for the working of a railway which is to be built in connection with the Toblach-Cortina d'Ampezzo line to Pieve di Cadore.

Russia.—La Société Metallurgique Dnieprovienne du Midi de la Russie are about to modernise their works in the Donetz district. Among other things an electric power plant of 10,000 H.P. is to be installed, the dynamos being driven by gas engines, actuated by means of blast furnace gas.

Sweden.—The Great Copper-beag Co., of Falun, Sweden, which is believed to be the oldest existing Chartered Co. in the world, having been founded in the 14th century, has made a loan of over £1,000,000 for various improvements in its steel, iron, wood pulp, paper and other works. A large portion of the amount will be spent in purchasing a waterfall, whilst about £500,000 will be spent on electrical machinery and the construction of electrical smelting furnaces, as it has been proved that the Gröndal method of smelting iron, by means of electricity, is eminently satisfactory.

Edinburgh.—The Corporation Electric Lighting Committee has accepted the sum of 21s. per light offered by the Cleansing and Lighting Committee for the lighting of public stairs in various districts.

Exeter.—The City Council has adopted the report of the resident engineer as to rewiring the asylum installation on modern lines. The estimated cost is £900, and it is proposed to spread the work over three years.

Fleetwood.—The U.D.C. has received the sanction of the L.G.B. to the borrowing of £3,197 in connection with the electricity undertaking. £2,357 is for expenditure on mains and services, and is repayable within a period of 15 years; £52 for new works, repayable within 14 years; £160 on meters, repayable within five years; and £159 for sundries, repayable within five years.

Leith.—A Scottish correspondent states that there is a probability that the Dock Commission will erect its own generating plant instead of as at present obtaining it from the town supply. A deputation has visited various towns in England, and favours the use of a producer gas engine plant.

London.—Hampstead.—At the meeting of the B.C. on April 7th it was decided to convert 317 street lamps from gas to electric lighting. The annual charge per lamp will be £2 19s. 6d., as against the present price of £3 4s. 9d. for gas. Ald. Hanbart asked the Lighting Committee whether it could not devise some better name than the "telephone" for the new system of charging for electricity recently introduced. Ald. Pritchard said the matter would be carefully considered.

Marylebone.—At the B.C. meeting on April 7th, Councillor Duncan Watson moved that an inquiry be held into complaints made by electrical contractors as to the methods of the Sales Department of the B.C. The motion was lost, only four members voting for it.

Manchester.—The Corporation has decided to apply for borrowing powers for £40,000—£10,000 for hired motors and £30,000 for sub-station plant.

Oswaldtwistle.—The U.D.C. has decided to apply under the Electric Lighting Acts to the B. of T. for a prov. order to authorise it to generate and supply electricity for power and lighting.

Oswestry.—The T.C. has invited the Electric Light Co. to tender for the lighting of the borough for a term of seven years.

Penistone.—The B.G. has appointed a committee to consider the advisability of having the Workhouse lighted by electricity.

Rochdale.—The T.C. has decided to apply to the B. of T. for powers to construct or to contract for the construction or working of the light railway authorised by the Bacup Light Railway Order, 1910.

St. Anne's-on-the-Sea.—At the monthly meeting of the U.D.C. it was pointed out that the proposed reduction in price would make considerable inroads into the profits of the electricity undertaking, which since the commencement had relieved the rates to the extent of about £3,500. If the reduction was acceded to, the department would probably have about £700 at the end of the year to hand over to the rates.

Senegal.—Under the auspices of the Compagnie Francaise d'Etudes et d'Entreprise Coloniales, a new company has lately been organised in Paris, with a capital of £40,000, and the title, La Compagnie d'Electricite du Senegal, to establish a central generating station for the supply of electricity for lighting and power purposes at Senegal and other districts of French West Africa.

Sheffield.—An agreement has been arrived at between the Electric Light Committee and the Yorkshire Electric Power Co., with reference to the supply of electricity by the Corporation to certain premises in the Parish of Tinsley. The terms agreed upon are as follows:—"The company will consent to the Corporation supplying electricity to certain premises in Tinsley on the Corporation agreeing that in the event of the company requiring to take over the supply of electricity to such premises, the Corporation will transfer the supply to the company on terms to be agreed between the Corporation and the company, or, in default of agreement, on terms to be determined by the B. of T." The mains and works to be laid and constructed to afford supplies at Tinsley are estimated to cost £990.

Tavistock.—At a meeting of the U.D.C. on Tuesday evening the Lighting Committee recommended the Council to support the application of Budge & Co., of Tavistock, for a prov. order under the Electric Lighting Acts. An amendment was moved that the Council would not oppose the application, provided the plans of the electric lighting scheme met with the approval of the Council, and this was carried by seven votes to six.

Thurstonland.—The U.D.C. has decided to approach the Yorkshire Electric Power Co. with reference to a supply of electricity.

Tonbridge.—With reference to the pumping plant for the sewage disposal scheme, the U.D.C. has been advised by Mr. A. E. Collins, of Norwich, to utilise electricity for pumping purposes, in preference to steam or gas.

Venezuela.—An American Consular report states that the rate charged per month for arc lights at Caracas is $17.01; and 11 cents per KW.-hour. Incandescent lamps of 16 C.P., all-night service, $1.15 per month. The Government is granted a discount on these rates of 25 per cent. No special contracts are made with large consumers. All bills are payable on the 1st of the month without discount. The electric light of the city of Caracas is supplied by the Compania Anonima de Alumbrado Publico from two plants, in one of which, the Junin, 200 H.P. is developed from gasoline motors, and 1,000 H.P. is taken from the plant of the Compania Anonima La Electricidad de Caracas, at Encantado, distant 9·6 miles, and from Los Naranjos, 12 miles. The El Paraiso plant has two gas engines of 70 H.P. each and one of 140 H.P., this plant also making coal gas and supplying the city.

The power developed by the Compania Anonima La Electricidad de Caracas amounts to 600 H.P. at Encantado and 2,000 H.P. at Los Naranjos. A new plant to develop 1,000 H.P. is being put in about two miles below Los Naranjos on the Guaire River. There are about 150 motors of all classes, according to the acting Consular agent in Caracas, and they pay 10 cents gold per H.P. per hour for power. The power company makes use of the waterfalls on the Guaire, using a Francis wheel at Encantado and Pelton wheels at the other two plants. The capitalisation of the power company is $579,000. The company proposes extending its plant. The plans and specifications for machinery, &c., were taken to Europe, and no doubt the improvements will be entirely with European machinery.

In La Guaira the electric light plant is under the direction of Carlos Pacanins, and supplies 88 arc and 564 incandescent lamps of 16 C.P. The charge here is 70 bolivars ($13.51) monthly for 1,200-C P. arcs and 5 bolivars (96½ cents) monthly for a 16-C.P. lamp for 10 hours or 500 KW.-hours. For power the charge is 10 cents for each 1,000 watts. The general expenses of this plant amount to $1,115 monthly.

Whitchurch.—At the next meeting of the U.D.C. a motion will be brought forward that a special meeting of the Council be held to consider the electic lighting question.

Whitehaven.—The T.C. has adopted a portion of the scheme proposed by the borough electrical engineer, involving the installation of economisers, mechanical stokers, a boiler, switchboard and motor-converter, estimated to cost £2,340; also of mains extensions, to cost £2,500. It has been decided to apply to the L.G.B. for sanction to borrow the necessary money.

Wolverhampton.—In consequence of the continual growth of the demand for electricity in the borough, especially for motive-power purposes, the Electricity Committee of the Corporation has presented to the T.C. an exhaustive report, setting forth the necessity for the provision of additional generating plant. Appended is a summary of the proposed extensions:—2,000-KW. turbo-alternator and condensing plant, 500-KW. rotary converter, switchgear, auxiliary plant, foundations and erection, £12,100; refuse destructor, 500-KW. mixed-pressure turbo-alternator, with condensing plant, piping, switchgear, foundations and erection, £4,200; extensions to feeder and distributing systems, main feeder, sub-feeders and feeder boosters, £1,920; distributing mains, £315; fitters' workshops, buildings and equipment, £1,850; services to consumers' premises, amount of new loan to be applied for £1,000; excess expenditure on £20,000 loan sanctioned in November, 1907, £807 8s.; contingencies and miscellaneous, £807 12s.; making a total of £23,000. Of the total amount £3,500 is covered by existing unexpended loans, leaving a balance of £19,500, for which additional borrowing powers are required. The T.C. at the monthly meeting, on Monday, approved of the extensions, and decided to apply to the L.G.B. for its sanction to the necessary loan.

Worthing.—Commenting on the electric lighting revenue account at a special meeting of the T.C., the chairman of the Finance Committee remarked that although the expenditure during the past half-year had been about £288 in excess of what they had anticipated, owing chiefly to the extra expenditure in coal, their receipts were £608 more than had been expected, and the result was that, instead of a deficit of £830, the actual deficit was only £438. He also explained that this deficit had been accumulating during the last four years, the last time that a subsidy was made from the rates being in March, 1906, when they transferred £500 for that purpose. In 1907-8 the cost of public lighting was reduced by £263, in 1908-9 by £557, and during the past year it had been again reduced by £296, in addition to which they were hoping to save another £279 in the coming year. It was also satisfactory to know that new customers had counterbalanced the loss to the undertaking consequent on the recent change to a more economical type of lamp for public lighting, and although the deficiency at the end of next September was estimated at £1,219, by the end of March next year they hoped to reduce that sum to £358, and to manage without calling for any more money from the General District Fund. Further, in addition to the interest and repayment of their loans, they were placing £500 a year to a depreciation fund.

Yarmouth.—At the T.C. on Tuesday last week the Electricity Committee reported that it had considered a recommendation from the Lamps Committee to light the whole borough with electricity, and resolved to ask the Council to carry out the work at the rate of 100 lamps per annum, costing £200, payable out of revenue, and that the balance of costs for mains and lamp standards be paid out of loan.

The Town Clerk was instructed by the Council to make application to the L.G.B. for sanction to a loan of £500 for H.T. mains, and one of £3,000 for L.T. mains.

TRAMWAY and RAILWAY NOTES.

Bolton.—A new car-shed, to accommodate 50 cars, and provided with accessory accommodation, has just been opened, the cost amounting to some £8,000.

Canada.—In the annual report of the Canadian Controller of Railway Statistics for 1909, the total electric railway mileage in 1908 was given as 989. The gross earnings for the year were $14,828,936, and the net income was $4,716,308.

China.—According to the report of the Compagnie de Tramways et de l'Eclairage de Tientsin for the last financial year, there was a marked falling-off in the number of passengers carried on the tramways, owing mainly to the depressed condition of trade. On the other hand, there has been a steady increase in the demand for electricity, the number of lamps installed having increased during the year from 10,823 to 14,081.

Continental Notes.—GERMANY.—It is announced that at the instance of the Prussian-Hessian State Railway Administration, the A.E.G. is to prepare a scheme for the establishment of a power station in the vicinity of favourably situated coalfields, which is to be able to supply several sections of the Prussian railways with power. The construction and working of the station are to be undertaken by the company. By means of improvements in the process of combustion, and the utilisation of the by-products thereby to be obtained, it will be possible to produce electrical power so cheaply as to ensure a decided advantage for electric traction as compared with steam locomotion. It is definitely expected that the preliminary works which have already begun in this direction will be successful, and that after the commencement this year of electric train working on the alternating-current system on the Dessau-Bitterfeld section, electrical working will probably be introduced on another section next year. This would imply, the company states, an important forward step in connection with the introduction of electric traction on main lines, as the railway authorities would only have to provide the rolling stock and line equipment, and would be relieved of the expenditure on the power station and the economic responsibility for its working.

SPAIN.—The Compania del Tranvia Urbano de Bilbao has applied for a concession to construct and work an electric railway in Bilbao, from the Plaza Circular to the railway station of the Ferrocarril del Norte. It appears that the above-mentioned company has obtained a concession for the construction and working of an electric tramway from the Calle de Fernandez del Campo to the Santander-Bilbao railway station (Bilbao).—*Board of Trade Journal.*

A company has just been formed in Brussels, with a capital of £280,000, and the title Biarritz-Saint-Sebastien-Tolosa, Société de Tramways Electriques, to construct and work an electric tramway between the places named.

FRANCE.—According to the *Daily Telegraph*, the municipal council of Paris has recently been much perturbed about the renewal of the concession to the City and Suburban Electric Tramway Co., which insisted on extending its overhead trolley system to the Arc de Triomphe. Much opposition was shown to the proposal to extend the trolley lines in the fashionable quarters, but eventually the common-sense arguments of a former chairman of the Council prevailed, and practically the whole scheme was agreed to. The trolley system can now be extended in numerous streets in the Northern quarters of the city as far as the Northern railway station.

Edinburgh.—Work has been begun on part of the Colinton tramway scheme, according to plans prepared by Messrs. Leslie & Reid, Edinburgh. The total estimated outlay at present is £4,000, and the contract has been placed with Mr. William Jackson, Edinburgh. The line will be available for conveying material for the construction of Redford Barracks. The tramway will be worked on the overhead trolley system. If terms for power cannot be arranged with the Corporation, the company will in all probability erect a power station of its own, in which case it will be in a position to offer electricity for the lighting of the Barracks and the village of Colinton.

Halesowen.—At the meeting of the U.D.C. on Wednesday last week, the clerk reported that a letter had been received from the Worcestershire C.C. stating that it proposed to commence the widening of Long Lane in connectjon with the light railway scheme on May 2nd, provided that all the land to be taken up was conveyed to the county authority; that a sum of £381 was collected from the landowners before the work was commenced, and that a sum of £619 was paid by the Halesowen Light Railway Commissioners. The clerk added that he had written to the C.C. to the effect that the sum of £619 was not due from the Light Railway Co. until the work was commenced on May 2nd, and the members of the Council expressed approval of his action.

Japan.—H.M. Commercial Attaché at Yokohama reports that a company has been formed to construct and work an electric railway between Tokio and Yokohama. The line is to have a length of about 15 miles, and a branch line nearly 4 miles long is to be built to Kamata on the State Railway. The line will be double tracked, with single overhead wires, and its gauge will be 3 ft. 6 in. The cost of construction is estimated at some £357,300. The name and address of the president of the promoters of the company in question may be obtained by British firms on application to the Commercial Intelligence Branch of the B. of T.

A scheme for the construction of an elevated electric railway in Tokio is at present under consideration. It is proposed that there shall be two lines, one running from the east to the west of the city, and the other from the north to the south. The cost of construction of the projected lines is estimated at £2,400,000.

According to the *Japan Weekly Mail*, electric railway enterprise promises to be the mania of the hour in Japan. No fewer than three companies had been competing for the Osaka-Nara concession, but they have now joined forces, the total capital involved being estimated at £300,000.

A new electric tramway between Fukuoka and Hakata has just been completed and put in operation.

Kirkintilloch.—At a public meeting of the inhabitants, it was decided to ask the T.C. to take immediate steps to approach the Glasgow Corporation for an extension of the tramway system from Bishopbriggs to Kirkintilloch, a distance of about five miles.

Llandudno.—Under the agreement with the Llandudno and Colwyn Bay Electric Railway Co., the U.D.C. on Saturday, April 9th, took a poll of the ratepayers on the Sunday running of the cars. The result was declared the same night as follows:—Against Sunday cars, 870; for, 467; majority against, 403. The number of ballot papers filled up, and found valid, was 1,337, there being only one spoilt paper. All the expenses of the poll are met by the tramway company, who have agreed not to claim a further poll for three years.

Stalybridge.—The engineer of the Stalybridge, Hyde and Dukinfield Joint Electricity Board has been instructed to prepare for submission to the next meeting a plan and estimate of the cost of a proposed tramway in Market Street, Stalybridge.

U.S.A.—A recent issue of the *General Electric Review* gives some details of a gas-electric tramway car recently completed by the G.E. Co. (N.Y.). The car is equipped with a four-cylinder four-cycle type gas engine, direct coupled to a completely enclosed generator and exciter. The generator is shunt-wound, and the exciter, in addition to the shunt winding, has a series field. Two 22-H.P. motors drive the car axles, being operated through controllers as in a trolley car. The result of a week's operation in December last shows operating costs amounting to 13·717 cents per car-mile, and revenue, 30·97 cents per car-mile. It should be stated that the car is a small one, seating only 26 inside passengers.

Wigan.—The T.C. has declined to entertain the proposal of the Lancashire United Tramways Co. to purchase the municipal tramways undertaking.

TELEGRAPH and TELEPHONE NOTES.

Wireless Telegraphy.—The United Wireless Telegraph Co., of New York, has received orders during the past month for the installation of the United system on no fewer than 46 ships, including many in British ownership.

The steamer *Makura, en route* to Sydney from Vancouver, held communication by means of her new wireless telegraph apparatus over a distance of 1,342 miles with Cape Flattery in one direction and with Honolulu, 1,003 miles in another direction, simultaneously. The *Makura* had also communicated over a distance of 2,800 miles with Vancouver.

An American company is endeavouring to obtain a licence to install a wireless telegraph system at Singapore and Hong Kong, affording communication with Yokohama, Shanghai and Bangkok.

Sir Robert Scott, the secretary of the Australian Postal Department, states that five tenders have been received for the erection of high-power wireless stations capable of transmitting over a distance of 1,250 miles. The estimated cost by the Conference in December last was £14,000 for each installation.

The wireless telegraph apparatus at Osezaki (Coto Islands, Japan) is being improved, in order that messages may be dispatched a distance of 1,000 miles.

The question of wireless telegraphy and shipping, which was referred to in our issue of March 25th, formed the subject of discussion at the joint conference of the Nautical Association and the German Sea Shipping Associations which was recently held in Berlin. Dr. Stugmann, general secretary of the Association of Hamburg Shippers, expressed the hope that the wishes of shipowners would be complied with at the international conference on wireless telegraphy, which is to take place in London in 1911, and he proposed a series of resolutions in the sense of the representations put forward in the issue in question. After Herr Schrader, wireless telegraph expert in the Imperial Post Office, had stated that the Government would look after the interests of shipping in every respect at the 1911 conference, the meeting adopted the resolutions.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 3rd. Sulphate of copper, for the P.M.G.'s Dept. in all States. Tender forms, &c., may be obtained at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

QUEENSLAND.—June 8th. Six sections of common battery switchboard and equipment, jumper wire, and cable, for the P.M.G.'s Dept. Tender forms, &c., at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

May 17th.—1,010 reinforced concrete telegraph poles, for the P.M.G.'s Department, Victoria. Forms, &c., at the Commonwealth Offices, London. See "Official Notices" April 1st.

May 18th.—Paper-insulated, lead-covered, and brass ribbon-tape cable, for the P.M.G.'s Department, Queensland. Forms, &c., at the Commonwealth Offices, London. See "Official Notices" April 1st.

June 8th.—Protectors, small switchboards, and common battery telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—June 1st. Eight sections of common battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

Belgium.—May 9th. Electrical appliances for the town workshop at the new North Docks, for the municipal authorities. Particulars (50 centimes) from Hôtel de Ville, Antwerp. A copy can be seen at the Board of Trade Commercial Intelligence Department in London.

Dartford.—April 20th. One feeder pillar and 1,350 yd. of paper-insulated and lead-covered cable, for the U.D.C. Electricity Department. See "Official Notices" April 8th.

Erith.—April 25th. Wiring scheme for three years, for the U.D.C. See "Official Notices" to-day.

Germany.—Tenders are about to be invited by the municipal authorities of the town of Zittau for the extension of the central electric lighting station at an estimated cost of £25,000.

Grimsby.—April 18th. Three-wire balancer and two years' supply of D.C. motor meters, for the Corporation Electricity Department. See "Official Notices" April 8th.

Halifax.—April 18th. One 300-KW. rotary converter, transformers and switchboards, for the Corporation. See "Official Notices" April 8th.

Llandudno.—April 23rd. Replating battery, paper and vulcanised cable, feeder and distributing pillars, joint boxes, &c., for the U.D.C. See "Official Notices" to-day.

Littleborough.—May 2nd. H.T. feeder cables, L.T. distributors, &c., and transformer kiosk, transformers, equipment, switchgear, &c., for the U.D.C. See "Official Notices" April 1st.

London.—L.C.C.—April 20th. Wiring and fitting for electric lighting at Shelburne Road and Torriano Avenue Schools. See "Official Notices" April 1st.

HAMMERSMITH.—April 20th. Stoneware cable-ducts, 1,750 yards 25 H.T. cable, and prepayment meters, for the Borough Electricity Department. See "Official Notices" to-day.

Manchester.—April 22nd. Five 600-KW. motor-converters or rotary converters and static transformers, for the Corporation Electricity Committee. See "Official Notices" April 8th.

Monte Video.—July 4th. Twenty electric cranes for the Harbour Authorities. Plans and specifications at the Secretary's Office of the Consejo de Administracion del Puerto de Monte Video. Tenders to the Consejo.—*Board of Trade Journal.*

Nuneaton.—April 25th. Water-tube boiler, feed-pump, pipework, valves, &c., for the Borough Electricity Department. See "Official Notices" April 8th.

Roumania.—May 25th. The municipal authorities of Vaslui are inviting tenders for the electric lighting of the town.

Spain.—The municipal authorities of Portella (Province of Lerida) have just invited tenders for the concession for the electric lighting of the town.

Turkey.—May 28th. H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the supply to the city of Constantinople of electrical energy. A deposit of £T10,000 (£9,000) will be required with each tender, and the tenderer must also supply certificates of his financial and technical ability to perform the work. Tenders, marked "Ministère Impérial Ottoman des Travaux Publics, Adjudication de la Concession d'Electricité de Constantinople," will be received at the Ministry up to May 28th. Local representation is essential in the case of Turkish Government contracts. A list of British commission agents established in Constantinople may be obtained, and copies of the specifications, &c. (in French), seen, by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Wallasey.—April 18th. Stores for the U.D.C. Electricity Department. See "Official Notices" March 18th.

Walthamstow.—April 22nd. One feeder booster set, and switchboard and accessories. See "Official Notices" April 1st.

War Office.—May 4th. Two electrolytic hydrogen and oxygen producing plants for the South Farnborough Balloon Factory. See "Official Notices" to-day.

West Bromwich.—May 2nd. 750-KW. D.C. turbo-generator and surface condenser for the Corporation Electricity Department. See "Official Notices" to-day.

Whitehaven.—May 2nd. Green's fuel economiser, feed and other piping, main switchboard for the Corporation Electricity Department. See "Official Notices" to-day.

Whitwood.—April 28th. Materials in connection with the proposed electricity supply, for the U.D.C. See "Official Notices" April 8th.

CLOSED.

Bedlay Colliery, Glenboig, N.B.—Messrs. Stevenson and McGuffie have accepted the British Westinghouse Co.'s tender of £2,716 for the exhaust steam turbine plant, &c., required at this colliery.

Blackburn.—The T.C. has entered into the following contracts for the Electricity Department for the ensuing year:—

L. Andrew & Co.—Armature insulating varnish.
Baxter & Caunter.—Screwed tubes for inside wiring.
R. W. Blackwell & Co.—P and B insulating tape.
British Insulated and Helsby Cables, Ltd.—House service fuse boxes.
British Westinghouse Electric and Manufacturing Co., Ltd.—Linen tape, shellac, motor starting switches.
Cresswell's Asbestos Co.—Packing and asbestos goods.
Eckstein, Heap & Co.—Ceiling roses, D.B.C.C. switches (10 amp.).
General Electric Co., Ltd.—Ebonite sheet and rod.
W. T. Glover & Co., Ltd.—Diatrine tape.
W. T. Henley's Telegraph Works Co., Ltd.—Waterproof tape.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—India-rubber solution, self adhesive compound tape.
John Lang.—Iron castings, firebars, pipes, &c.
Micanite & Insulators Co., Ltd.—Micanite plate.
Siemens Bros.—Ozokerit and non-hygroscopic tapes, &c.
Spicer Bros.—Red fibre sheet, pressspahn sheet.
J. H. Tucker & Co.—Tumbler switches, lampholders.
Watlington & Co.—P and B insulating paint.
Booth & Openshaw.—Resin, wax, paints, &c.
Vacuum Oil Co.—Oils.

Bradford.—The T.C. has accepted the tender of Messrs. Thermit, Ltd., for materials for the welding of 600 tramway rail-joints, at £596.

Carlisle.—The following tenders have been accepted for the electricity works extensions:—

Engines, dynamos, &c.—Browett, Lindley & Co., £4,460.
Condensing plant.—Korting Bros., £398.
Three boilers, economisers and pumps.—Stirling Boiler Co., £3,359.

Colchester.—The T.C. has accepted the tender of the Standard Cable Co., Ltd., for cable, at £242.

Guildford.—An order for the large storage battery required by the Guildford Electricity Supply Co., Ltd., has been placed with the D.P. Battery Co., Ltd., who have also undertaken its maintenance for a period of 10 years.

London.—BATTERSEA.—The B.C. Lighting Committee has accepted the tender of the General Electric Co., Ltd., for carbons for lamps, &c., and that of Callender's Cable Co. for cables, &c. Contracts are not to be entered into at present for service joint-boxes, electricity meters, and metal-filament lamps, but quotations for these will be obtained as and when required.

Manchuria.—The contracts for the electric lifts for the South Manchurian Railway, and also for the Shanghai Municipal Council Buildings, have been obtained by Messrs. A. W. Penrose and Co., Ltd., of London, in competition with German and American makers.

Nelson.—The T.C. has accepted the tender of Messrs. Brooks & Brooks, of Burnley, for the supply of coal to the Electricity Department.

Plymouth.—The T.C. has accepted the tender of Messrs. Willoughby Bros., for annual supplies of tramway brake blocks, at 6s. 6d. per cwt.; brake slides, 2d. each; steel slipper block bolts, 5d. each; and steel suspension bolts, 1s. 4d. each.

Sheffield.—The Tramways Committee has accepted the tender of Hadfield's Steel Foundry Co., Ltd., for special work, comprising junctions required for track renewals in Hounsfield Road, and from Fitzalan Square to the Wicker, at £1,000 plus £213 for rails and fishplates to be supplied by the Corporation. The Electricity Committee has accepted the tender of the Electric Construction Co., Ltd., for a rotary transformer and switchgear, at £303.

St. Helens.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for low-tension cable for extensions.

Tonbridge.—The U.D.C. has accepted the following tenders for stores for the electric light department for a year:—

British Thomson-Houston Co., Ltd.—Meters (motor type).
Geipel & Co.—Carbons.
Western Electric Co.—Cables.

Wrexham.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., to lay 600 yd. of cable, for £135.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 15th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Discussion on Dr. J. Morrow's paper on "A Heat Diagram for use in Steam Turbine Design."

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, April 19th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Annual general meeting. Paper on "The Application of the Cradle Dynamometer to the Testing of Electrical Machinery," by Messrs. F. Shaw and J. Davies.

Institution of Electrical Engineers (Leeds Section).—Wednesday, April 20th. At 7.15 p.m. At the University, Leeds. Annual general meeting.

Institution of Electrical Engineers (London).—Thursday, April 21st. At 8 p.m. At the Institution of Civil Engineers. Paper on "Hydro-Electric Installations of Sweden," by Mr. A. V. Clayton.

Physical Society.—Friday, April 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Magnetic Balance of Curie and Cheneveau," by Messrs. C. Cheneveau and A. C. Jolley.

Royal Institution.—Friday, April 22nd. At 9 p.m. Discourse on "The Telegraphy of Photographs, Wireless and by Wire," by Mr. T. Thorne Baker.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are announced:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Saturday April 16th.—"A" and "B" Companies' drill order, 3.30 p.m., headquarters.

Monday, April 18th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill 7 to 9.30 p.m.

Tuesday, April 19th.—"B" Company. Infantry drill, 7 to 8 p.m.; technical drill, 8 to 10 p.m.

Wednesday, April 20th.—Gymnasium, 6 to 9.30 p.m.

Thursday, April 21st.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill 7 to 8 p.m.; technical drill, 8 to 9.30 p.m.

Friday, April 22nd.—"D" Company. Recruits' infantry drill, 6.15 to 6.45 p.m.; company drill 7.30 to 8.30 p.m.; technical drill, 8.30 to 9.30 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

NOTES.

Electric Shock Fatality.—An inquest was held last Friday into the death, at Sandwell Park Colliery, West Bromwich, of Thomas Walter Ward, who was employed as a sinker at the colliery in the Jubilee pit. Albert Ward, brother of the deceased, who was working with him, stated that their duty was to remove a set of cables from one position to another. Witness and a man named Kiteley were working on the upper deck of the cage, and his brother was on the lower deck. They worked all night (Tuesday) without anything happening, but at about 6.15 next morning he heard his brother groan. Witness immediately went to aid him, but directly he caught hold of him received an electric shock. Kiteley had called out to him not to touch his brother, who fell backwards into the "sump" at the bottom of the shaft. The sump would be about 40 yards deep and contained water. In answer to the Coroner, witness said he had heard there was a rule at the pit that when men were working at the cables the current should be cut off. His brother was in charge of the work at the time, but witness knew the current was not cut off.—Herbert Kiteley gave corroborative evidence.—In reply to Mr. H. Johnstone (Inspector of Mines), witness said there were instructions and rules which were posted at the pit bank. He had never read them. He was able to read.—Mr. Johnstone: Yet you did not think it worth while to read them, though your life might depend upon it?—The Coroner: Do you know that the motor should have been switched off?—Yes.—The Coroner: Why was it not?—I don't know.—William Aldridge, night engineer at the colliery, said that the electric motors carried 550 volts. Witness gave instructions to the men, telling them to be careful what they were doing. He told deceased to have the current switched off before touching the cables. Joseph Simpson, mechanical engineer, stated that he told Ward to switch off the current when working in the shaft, and notices to this effect were posted on the bank. The jury returned a verdict of "Accidental Death," and expressed their opinion that it was caused by an electric shock, for which no blame was attached to anyone.

Glasgow Corporation Contracts.—Some time ago the Glasgow T.C., after a lengthy discussion, passed a resolution providing that in all schedules and specifications issued by the Corporation, preference should be given to goods of British manufacture, while later a second decision, amending the first, was arrived at to the effect that provision be made in all such schedules and specifications for foreign offerers or other agents producing evidence to the effect that their works were carried on in conformity with the T.C.'s standing orders relative to the standard rate of wages and other conditions of labour. The decisions were remitted to a special sub-committee, at the meeting of which there was diversity of opinion, and a proposal that the first part of the Corporation's finding be disapproved. This minute then came before the meeting of the T.C., at which Bailie Russell, the convener of Tramways Committee, read the following letter which had been received by the Town Clerk:—

"Dear Sir,—We are returning you the form of tender for electric cables required by your Electricity Department for ensuing 12 months, without having filled in any prices for same. Our consideration has just recently been directed to the circumstances under which our last tender for paper-insulated cables was declined by your Tramways Committee; and if the newspaper reports of the discussion which then took place are accurate, it would appear that we should not be awarded the contract even if our prices again proved to be the lowest submitted to you. As the preparation of a tender such as you are now calling for entails a very great amount of labour and expense, and as the decision of your Tramways Committee in the previous instance no doubt expresses their settled policy, which makes it clear that they have no desire to consider our offer, we would beg you to excuse us from submitting any tender at all.—Yours faithfully, STANDARD CABLE MANUFACTURING CO., LTD."

Mr. Willock thereafter moved that the resolution giving preference to goods of British manufacture be rescinded, and the standing orders were suspended to enable him to do so. When Mr. Willock was speaking, it was proposed that the house be counted, as there were doubts as to a quorum being present. No amendment was proposed, and the chairman declared Mr. Willock's proposal carried.

Electric Motor in a Thimble.—According to a correspondent of the *Daily Mail*, M. Trevet, a poor workman of Paris, has constructed one of the smallest electric motors in the world. It weighs about ¼ oz., and will go into an ordinary thimble. It was shown working before members of the Academy of Sciences, at 3½ volts.

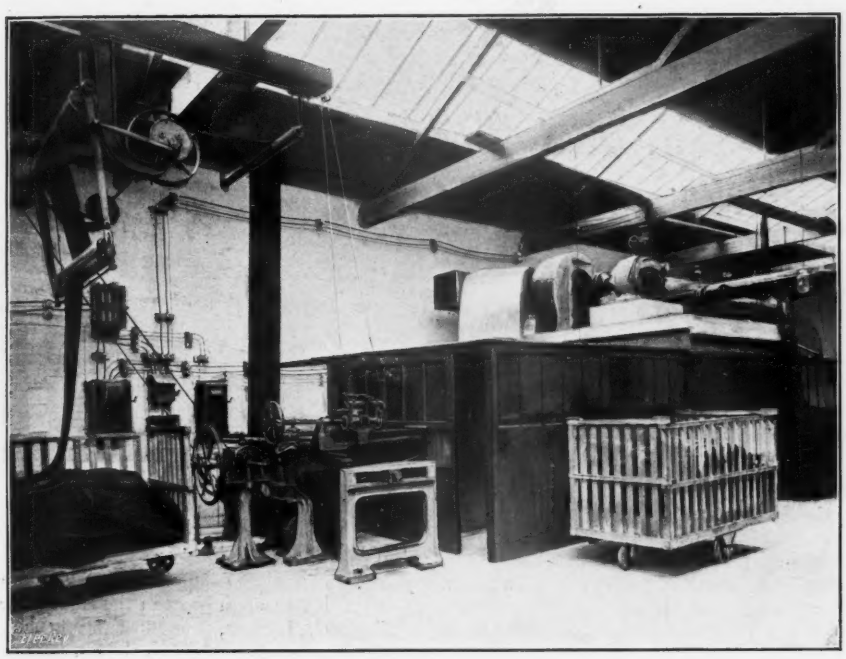
Appointments Vacant.—Switchboard attendant for the Stirling Electricity Works (£1); switchboard attendant for the Durban Corporation Electricity Works (£240); assistant for the engineer-in-chief's department of the Westminster Electricity Supply Corporation, Ltd. (£120); permanent way foreman for the Sunderland and District Electric Tramways, Ltd. (see our advertisement pages in this issue).

Life in Shanghai.—Can any reader now in England oblige an inquiring correspondent with information regarding living in Shanghai—the climate, cost of living, state of the electrical industry, rate of exchange, number of Europeans, and so on?

(*Continued on page* 608.)

THE USES OF ELECTRICITY AT THE WORKS OF THE MANCHESTER DYERS, Ltd.

That the advantages of electric driving for industrial purposes of every description are steadily receiving more and more recognition in all our manufacturing centres is every day increasingly evident. Old-established firms are finding it to their advantage to discard their steam plant and equip their works with electric motors, while new companies are in very many instances arranging from the start for electric driving.



Stentering Machine.

The Manchester Dyers, Ltd., come under this latter heading, and while their electrical installation possesses no extraordinary features, it yet merits attention as forming one more example of the application of electricity to motive power.

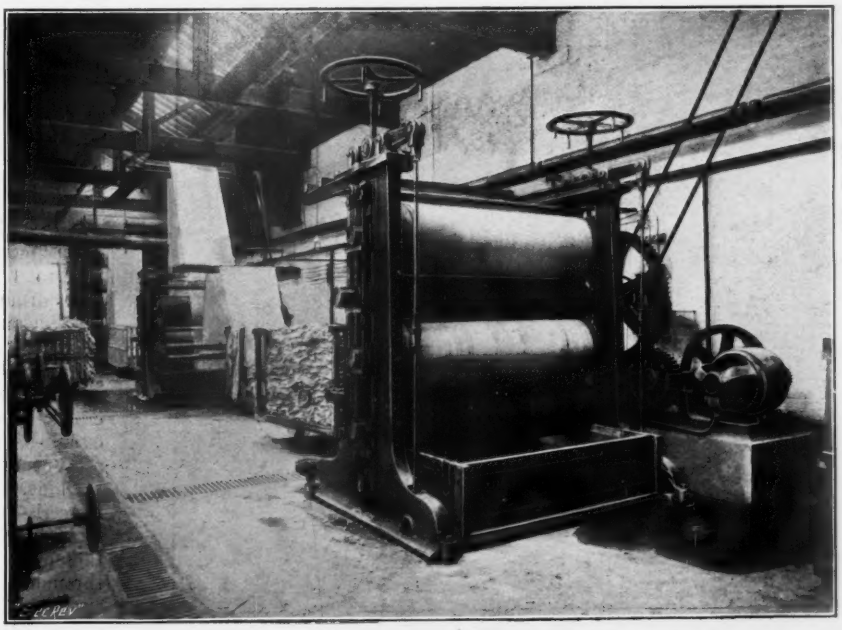
It is frequently urged that it is cheaper to generate one's own electricity than to obtain it from public supply mains, but it would appear that, especially in large centres like Manchester, the price per unit is being reduced to a figure that competes with a private supply.

The Manchester Dyers, Ltd., although they generate a great deal of steam for their various processes, yet take their electric power from the Corporation mains, and we recently came across another instance, also in Manchester, where actual trial was made with an oil engine driving a dynamo, and though the cost of generation was very low, the firm finally decided that, taking everything into consideration, it would pay them to take their power from the public mains.

At the works which we have under notice, the supply is taken, as already stated, from the Manchester Corporation mains, which are in duplicate, the current being three-phase, 50 cycles at 6,600 volts.

These mains are brought into a sub-station containing a H.T. switchboard, two Bruce Peebles motor-converters, and a L.T. direct-current switchboard.

After passing through the H.T. switches the current is led, as desired, to the H.T. side of one or other of the motor-converters and issues thence, as continuous current at 220 volts, to the L.T. switchboard. The whole of the sub-station equipment, with the exception of the L.T. switchboard, is the property of the Manchester Corporation, by whom it was installed.



Drying Rolls.

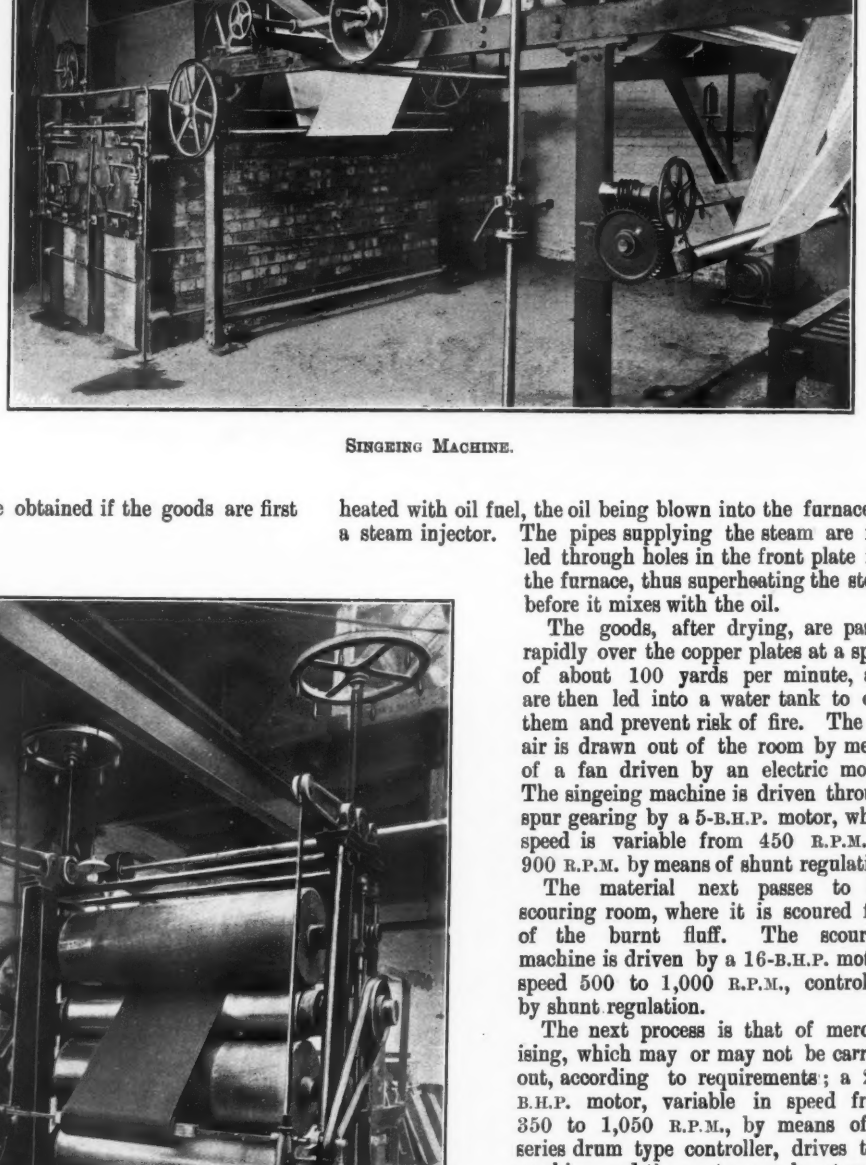
The motor-converters are each of 100-KW. capacity, and receive three-phase current at 6,600 volts, converting it to continuous current at 220 volts, the speed being 750 R.P.M. One converter acts as a stand-by for the other, though they can be run in parallel if desired.

On the L.T. switchboard are two motor-converter panels receiving the direct current and transferring it to two circuit panels, which control seven power and two lighting circuits.

We now proceed to describe the motor equipment, following the sequence of operations round the works.

As in the Collyhurst Finishing Co.'s Works, which are described in another article, the stock-room is on the first floor; the goods to be dyed are passed over wooden rollers to the singeing room. Before being singed they travel round a set of drying rolls, as it is found that much better results are obtained if the goods are first thoroughly dried.

The singeing machine, shown below, consists of two semi-cylinders of sheet-copper mounted on brickwork, and is heated with oil fuel, the oil being blown into the furnace by a steam injector. The pipes supplying the steam are first led through holes in the front plate into the furnace, thus superheating the steam before it mixes with the oil.



Singeing Machine.

Three-Bowl Calender.

The goods, after drying, are passed rapidly over the copper plates at a speed of about 100 yards per minute, and are then led into a water tank to cool them and prevent risk of fire. The hot air is drawn out of the room by means of a fan driven by an electric motor. The singeing machine is driven through spur gearing by a 5-B.H.P. motor, whose speed is variable from 450 R.P.M. to 900 R.P.M. by means of shunt regulation.

The material next passes to the scouring room, where it is scoured free of the burnt fluff. The scouring machine is driven by a 16-B.H.P. motor, speed 500 to 1,000 R.P.M., controlled by shunt regulation.

The next process is that of mercerising, which may or may not be carried out, according to requirements; a 25-B.H.P. motor, variable in speed from 350 to 1,050 R.P.M., by means of a series drum type controller, drives this machine, and the motor can be stopped by the attendant from three different points by button switches, which short-circuit the coil of a magnet on the circuit-breaker, which magnet holds the circuit-breaker in. This is necessary on account of the great length of the machine. An 8-H.P. motor drives the merceriser pump.

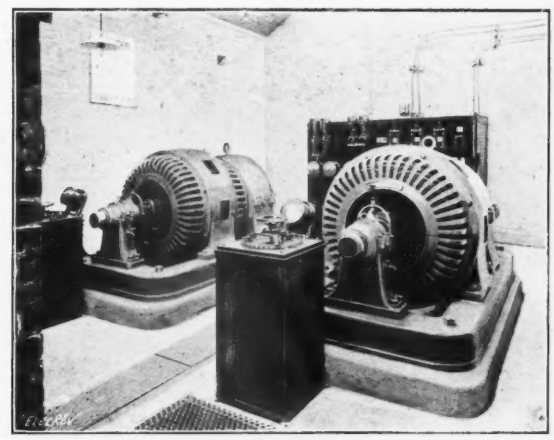
After being mercerised the goods are thoroughly washed, and are then put through the drying rolls. These consist of hollow copper cylinders heated by steam, which are mounted and geared together so that the material passes

round each roller in turn; one of these machines has as many as 24 rollers.

At this stage the goods are ready for dyeing, the only colour used by this firm being black; they are passed through vats containing a black aniline dye which, curiously enough, does not appreciably alter their colour, this process being effected at the next stage—viz., in the ager. This machine heats the material to about 150° F. and brings out the black colour; the goods being next chromed and then once again dried, the dyeing is complete.

In the mercerising room besides the merceriser are a 4-bowl mangle, a 3-bowl mangle and a drying range, this last being the machine referred to above as having 24 rollers.

The two first-named machines are each driven by an 18-B.H.P. motor running at 1,000 R.P.M. and transmitting the power through spur gearing; each motor is fitted with a drum type controller. The drying range is driven in the same manner by a 5-H.P. motor, with shunt regulation for speeds from 450 R.P.M. to 1,130 R.P.M. There is another similar machine in the chroming room.



Sub-Station, Showing Peebles Motor-Converters (H.T. End) and L.T. Switchboard.

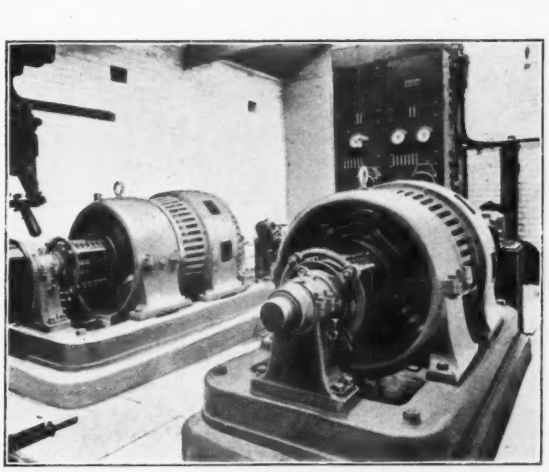
The chroming and washing machine is run by a 16-B.H.P. motor, with shunt speed regulation from 500 R.P.M. to 1,000 R.P.M.

When the dyeing process is complete the material is taken to another room to be filled, or stiffened, and then passes to a machine called a stenter, which stretches it to its original width, this being necessary as the stuff shrinks during the former processes; at the same time the stenter frees the goods of superfluous filling medium, and as hot air is passed through the stenter housing the material is also dried. Four motors are employed to drive the machinery in this room, viz., one of 20 B.H.P. for the stenter chain, speed 750 to 1,500 R.P.M.; one of 5 B.H.P. for the stenter jig motion, speed 450 to 900 R.P.M.; one of 25 B.H.P. for the fan drawing hot air through the stenter housing, speed 750 R.P.M.; and one of 25 B.H.P. for the filling mangle, speed 350 to 1,050 R.P.M.

The material, after passing through the stenter, is put into stock, to be brought out and "finished" as and when required.

In the finishing room are one four-bowl mangle, one three-bowl calender, two Schreiner calenders and one lapping machine, which last folds up the material into 1-yard laps, the laps being afterwards counted and the total length thus ascertained.

The four-bowl mangle is driven by an 18-B.H.P. motor, running at 1,000 R.P.M., which is provided with a drum controller; the three-bowl calender has a 40-B.H.P. motor, speed 700 R.P.M., with a liquid starter, and the two Schreiner calenders are each driven by an 18-B.H.P. motor, running at 1,000 R.P.M., which is regulated by a drum controller. Schreinering is a most interesting and beautiful process to watch.



L.T. End of Motor-Converters, and H.T. Switchboard.

This machine is like a calender, consisting of a large roller at the bottom made of pieces of linen placed on a spindle and compressed between end plates under enormous pressure, and then turned up in a lathe to make a roller; above this is the Schreiner roller, which is a hollow steel cylinder engraved with very fine lines, from 250 to 500 per inch; this cylinder is heated internally by gas, and means are provided for putting great pressure on the rollers.

As the material enters the rolls it has the ordinary appearance of cotton goods, but on issuing from them it has a satin finish on one side, owing to the action of the Schreiner roller, which makes an impression on the material of all the fine lines which are engraved on it; this has the effect of giving the material rows of regular reflecting surfaces, and hence a glossy appearance.

The pressure is put on by hydraulic means, and amounts normally to about 70 tons. The motors which drive the Schreinering machines drive also the hydraulic pumps.

From the calenders the goods pass to the lapping and measuring machines, and finally to the parcelling room.

In a works such as that of the Manchester Dyers, Ltd., electric motors are particularly useful, as the ease with which they can be started and stopped, or the speed altered, is a very great convenience.

The ability of motors to withstand severe conditions is also evident here, as some of the rooms are generally so full of steam that it is impossible to see one's way about. Almost the whole of the machinery in these works, including singeing, mercerising, drying, stentering and other machines, in addition to the entire electrical equipment from the L.T. side of the motor-converters in the sub-station, consisting of motors, switchgear, cables, lighting, &c., was supplied and erected by Messrs. Mather & Platt, Ltd., Salford Iron Works, Manchester.

To this firm, and to the courtesy of the manager of the Manchester Dyers, Ltd., we are indebted for the foregoing details.

"Sentinel" Generating Sets.

It goes almost without saying that the ideal method of lighting a factory is by means of electricity, and where, as is often the case, surplus steam is available, it will often pay to install a small electric generating plant. The "Sentinel" junior lighting sets, made by Messrs. Alley & MacLellan, of Glasgow, are particularly suited for this class of work, such points as efficiency, durability, and automatic lubrication and working having been carefully studied. Dynamos of any make can be supplied, and as the "Sentinel" generating sets run up to 500 KW., in size, they are adapted not only for auxiliary, but also for main driving purposes, being very economical in steam consumption when used for the latter purpose in large sizes.

ELECTRIC INDIVIDUAL DRIVE IN CONTINENTAL TEXTILE MILLS.

WITH DESCRIPTION OF THE COMPLETE EQUIPMENT OF ALL MACHINES ON THE SINGLE-DRIVE SYSTEM AT MESSRS. BUCHALY & HERBERTZ'S NEW MILL, M.-GLADBACH.

By W. R. ROTHENBERG.

THERE can be no doubt that the electric transmission of power in textile mills in this country is in the ascendant, and has made remarkable progress during the last few years. There are already many Lancashire and Yorkshire mills fitted out with complete electrical equipments, all of which, however, are on the group system, whereas on the Continent individual motors for each machine are now being used generally in textile mills. Only three-phase alternating current motors are employed, which are mostly of the totally enclosed squirrel-cage type. The use of totally enclosed motors for textile mills is naturally a very important factor, as they have to be protected against the dirt and dust which accumulate to a large extent in mills. The so-called enclosed ventilated type of three-phase motor is rarely used, as it requires too much attention, necessitating frequent cleaning and overhauling of the various parts. Fig. 2 shows a three-phase A.C. "Schorch" motor, fitted with short-circuited rotor, totally enclosed, together with an automatic belt tightener. It must, however, be admitted that these completely covered-in motors are liable to become more heated than the "enclosed ventilated" type; this disadvantage may be overcome by using motors of the highest efficiency under varying loads. It is not sufficient that the efficiency should be high only at normal load. Fig. 3 shows the efficiency curve of a "Schorch" motor, such as is constructed for a normal load of 1 H.P. These motors are of the kind used on the Continent now quite generally for the direct driving of woollen looms, and as can be seen, have an average efficiency of about 87 per cent. A great advantage in economy in power is, of course, gained by such highly efficient motors, but as the first outlay for electrical installations in mills on the single-drive system is more costly than on the group-drive system, this is sometimes an obstacle to its adoption. Tests carried out in various mills with these "Schorch" single-drive motors have shown an economy in power to the extent of 50 per cent. for single drive over group drive, and this was recently again proved at a

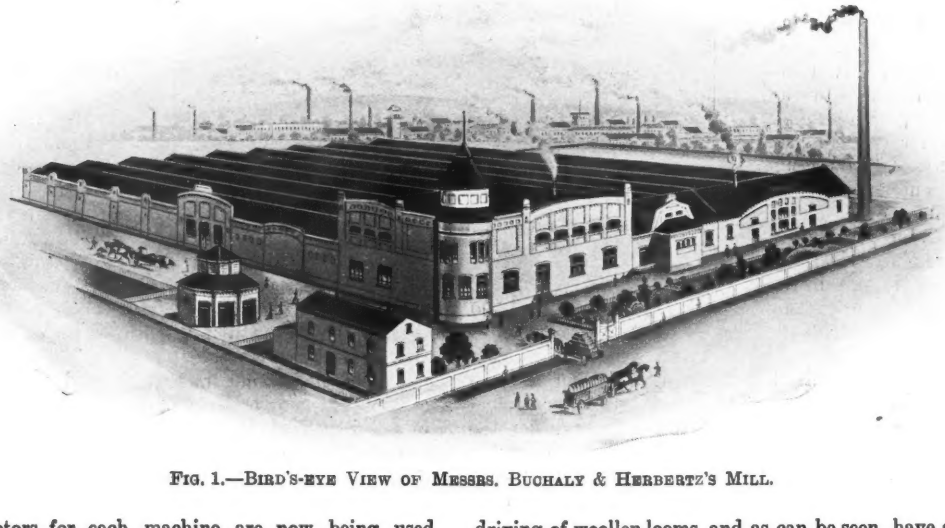


FIG. 1.—BIRD'S-EYE VIEW OF MESSRS. BUCHALY & HERBERTZ'S MILL.

FIG. 2.—THREE-PHASE "SCHORCH" MOTOR.

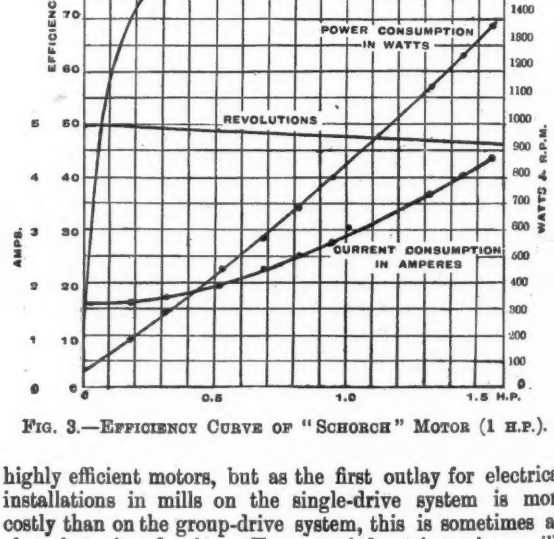


FIG. 3.—EFFICIENCY CURVE OF "SCHORCH" MOTOR (1 H.P.).

smaller newly erected textile mill belonging to Messrs. Buchaly & Herbertz, M.-Gladbach, for which the Schorch Electrical Co., electrical engineers and manufacturers, of London and Rheydt, carried out the entire electrical equipment of all machines on the single-drive system, and which will be fully described in the following article.

When establishing new mills in the textile district around M.-Gladbach, the usual custom is to erect them on rented

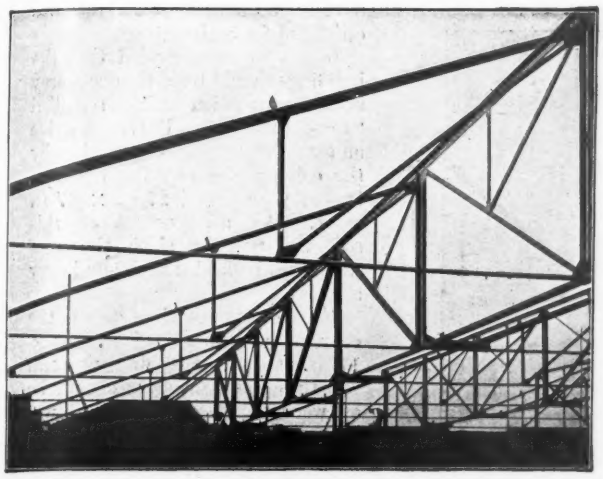


Fig. 4.—Roof of Mill, Showing Light Construction for Single-Drive System.

property, especially in cases where the mills are to be of small capacity. In such cases a certain annual charge is made for the rent of the property and for the necessary power for driving the machinery.

These circumstances cause great inconvenience, especially when the tenant wishes to extend his mill, and for this reason he will seek to obtain a site of his own as soon as possible. Formerly, however, this could only be done when the mill was not required to be of very limited capacity, as otherwise the cost of power would be prohibitive.

In order to arrive at economical conditions in the cost of power, the owner when erecting a mill of his own would often build the mill larger than was necessary for his immediate requirements, and let a part of the property to another firm, so that the firm which was formerly in the position of tenant would then occupy the position of landlord. The above-mentioned inconvenience was not totally eliminated thereby, but no other solution of the difficulty was possible if the firm had to meet competition satisfactorily.

The firm of Messrs. Buchaly & Herbertz, M.-Gladbach, which was founded in the year 1891, conducted its business formerly on rented property, but for some time previous to that date had the intention of building its own mill, and for this purpose had obtained a suitable site.

The erection of the mill was, however, constantly postponed because the estimated running costs showed no advantage over their old system unless they built a mill larger than they required, sub-letting a part to another firm. These conditions Messrs. Buchaly & Herbertz wished to avoid.

At that time arrangements were being made near their site for the erection of a three-phase alternating-current power station at M.-Gladbach, which was intended for supplying power principally to textile mills, and for industrial purposes, and Messrs. Buchaly & Herbertz decided to postpone the erection of their mill until they should be in a position if necessary, to take their power from the local electric supply company. Apart from this, it was anticipated that owing to high prices in the building trade during the years 1905-7, the erection of their mill would prove very expensive, and for this reason also it appeared advantageous to wait until the conditions changed.

The beginning of the year 1908 saw a reduction of prices in the building trade, and as the M.-Gladbach Electric Supply Co. were ready to supply the three-phase current, Messrs. Buchaly & Herbertz definitely decided to commence the erection of their mill.

Two important questions were now to be decided :—

1. Whether it would be advantageous to generate their own power, or to take it from the M.-Gladbach Electric Supply Co.

2. Whether the mill should be arranged on the group-drive or single-drive system.

As indicated above, the connecting of the installation to the mains of the Electric Supply Co. offered obvious advantages (similar to those of the Lancashire and Yorkshire Electric Power Companies in this country), and the only question was whether the M.-Gladbach Electric Supply Co. would ask such a price for electrical energy as would favourably compete with the figure at which Messrs. Buchaly & Herbertz could generate their own current.

Negotiations with the Electric Supply Co. proved more difficult than was anticipated, the cause of this being the considerable difference between the energy consumptions estimated by the various interested parties.

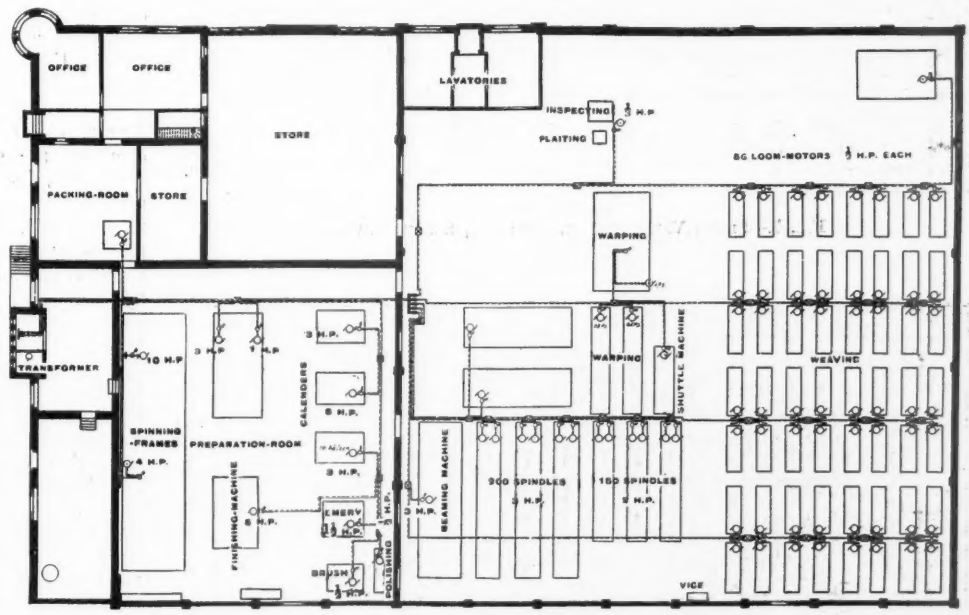


Fig. 5.—Plan of Messrs. Buchaly & Herbertz's Mill.

To drive the machinery 105 H.P. was necessary. On the assumption that this power would be used constantly, the energy consumption for 3,000 working hours would be 315,000 H.P.-hours, corresponding to about 250,000 KW.-hours.

Actual practice shows, however, that the machines are never all constantly in use, and certainly never all on full load. A maximum running coefficient for all machines would come out at about 50 per cent., so that the energy consumption may be taken as 125,000 KW.-hours.

G

This value was in many cases given by experts in reply to Messrs. Buchaly & Herbertz's inquiries, and it may here be mentioned that this figure was based upon results which had been obtained with group drive, so that the losses in shafting were taken into account.

As a result of their wide experience in the driving of textile machinery, the Schorch Electrical Co. gave as the annual energy consumption only 70,000 KW.-hours.

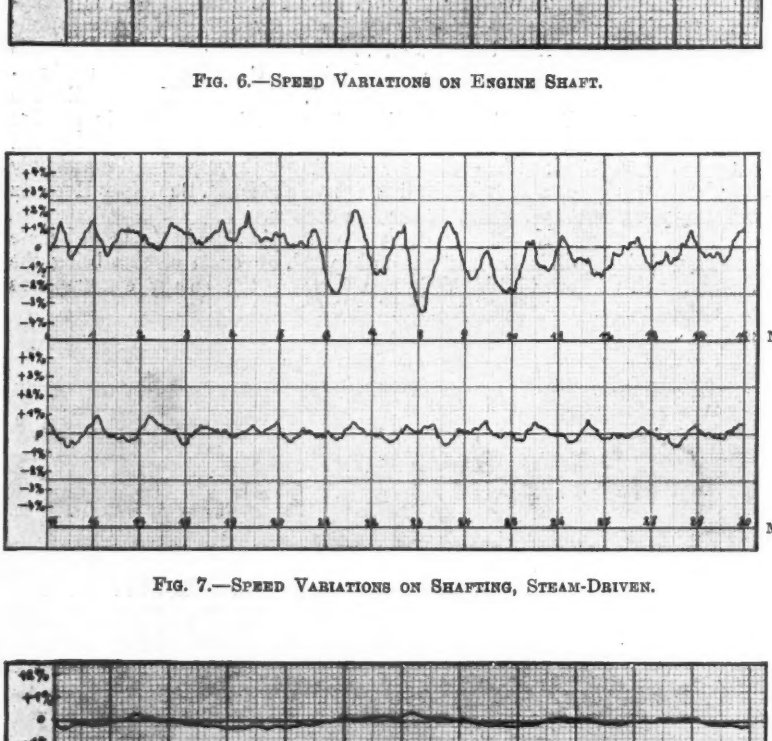


FIG. 6.—SPEED VARIATIONS ON ENGINE SHAFT.

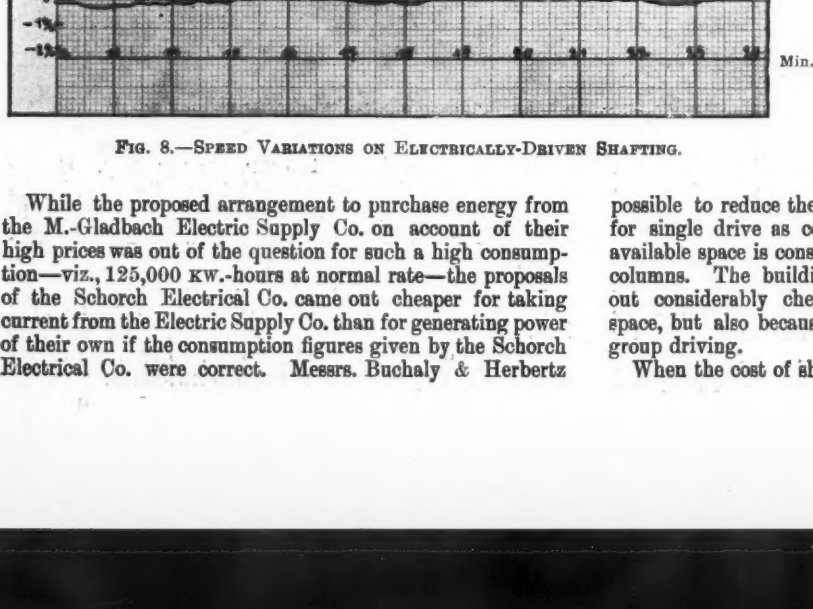


FIG. 7.—SPEED VARIATIONS ON SHAFTING, STEAM-DRIVEN.

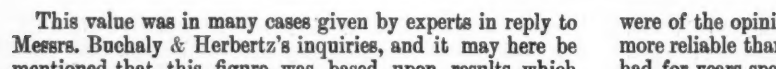


FIG. 8.—SPEED VARIATIONS ON ELECTRICALLY-DRIVEN SHAFTING.

While the proposed arrangement to purchase energy from the M.-Gladbach Electric Supply Co. on account of their high prices was out of the question for such a high consumption—viz., 125,000 KW.-hours at normal rate—the proposals of the Schorch Electrical Co. came out cheaper for taking current from the Electric Supply Co. than for generating power of their own if the consumption figures given by the Schorch Electrical Co. were correct. Messrs. Buchaly & Herbertz were of the opinion that the figures given by the latter were more reliable than others, owing to the fact that this company had for years specialised in the equipment of textile mills on the single-drive system, accordingly Messrs. Buchaly & Herbertz were in a position to negotiate with the Electric Supply Co. for a rate for supplying energy.

Having arrived thus far, the question now was to settle whether they should finally decide upon the single or group-drive system, and in order to make a clear comparison the cost was estimated for both systems.

It was at once decided that the buildings should be of the one-storey shed construction with so-called "saw-tooth" roof. For single drive an arrangement was chosen whereby the columns for carrying the roof trusses were placed 27 ft. × 67 ft. apart. An arrangement of this sort was possible, since the roof would not be loaded with any heavy shafting.

For the group-drive system the columns were arranged 27 ft. × 17 ft. apart; the first proposal was that the main stays should be of wood, but an alternative was suggested for main stays of U-iron.

The design of the building was entrusted to Mr. Hermann, architect at M.-Gladbach, and careful calculations based on normal prices for materials gave the following results:—

The price of the roof construction, including the columns, for an area of 2,300 sq. metres under the single-drive system, with pilasters 27 ft. × 67 ft. apart, came out at £450. For group drive with main-stays of wood, with columns at a distance apart of 27 ft. × 17 ft., the price was £550. For main stays of U-iron instead of wood the price arrived at was £600. All these prices exclude the roof covering. The result of these investigations disclosed the somewhat surprising fact that, in spite of the considerably greater distance apart of the columns, the building for the single-drive system came out cheaper than that for the group-drive system.

The assumption can also fairly be made that roof repairs on the single-drive system would be far less than for group drive, as it is impossible to avoid continual vibration due to the shafting on the latter system, and this naturally loosens the covering material.

As a result of the distance between the main columns, the arrangement of machinery was in no way disturbed on the single-drive system, and a practical distribution was possible, which, of course, meant that more machines could be arranged in a given floor space.

Investigation proved that it was possible to reduce the size of the building by 10 per cent. for single drive as compared with group drive, where the available space is considerably reduced owing to the many columns. The building, therefore, for single drive came out considerably cheaper not only per square yard floor space, but also because it could be built smaller than for group driving.

When the cost of shafting was taken into consideration, it

was shown that the installation costs for the single-drive system were in this instance no higher than for the group-drive system.

The advantages which the single-drive system offers were thus obtained without any extra cost, but these advantages are so considerable that even in cases where the single-drive system comes out more costly in the installation than group drive, the preference should in most cases be given to the single-drive system.

Many of its advantages are well known, and it is, perhaps, unnecessary in this instance to go fully into the matter. But it may be mentioned that, owing to the absence of all shafting and belting, a much better light, ample ventilation and suitable atmospheric conditions are obtained.

As time goes on, it is found that light is more and more important. It is not sufficient to be able just barely to see what is going on in a department—an abundance of light must be provided. The best practice seems to be to keep the maximum of window surface in the sides of the building, and at the same time to provide an abundance of overhead light by means of the "saw-tooth" roof. This type of building was adopted by Messrs. Buchaly & Herbertz, as can be seen from figs. 1, 4 and 5.

One circumstance, which in many cases is not sufficiently emphasised, was at once apparent in the building in question, and this was the special advantage gained by adopting the single-drive system, from the arrangement of the roof columns. The arrangement of the whole installation was in no way disturbed, as is the case in the group-drive system, by frequent roof columns and shafting.

Even while the building was being erected alterations were made in the position of machinery, with no disadvantage to the general arrangement. Such alterations would have been out of the question with the group-drive system.

It is not improbable that in the event of future extensions changes might be necessary in one or more departments, and the absolute independence of position in the erection of machinery will prove of great value.

That single drive uses less power than group drive need scarcely be proved at the present day. It should, however, be mentioned that only a few years ago the reverse was held to be the case, and tests made at that time did not show any economy for the single drive.

The conditions have, however, undergone a considerable change since the Schorch Electrical Co. brought out their special motors for textile purposes. Their own works being situated in the middle of the textile industry in the Rhine province placed them in an excellent position to study carefully the requirements of the textile industry, and they quickly came to the conclusion that electric driving could only be introduced by considering the running costs in preference to the first cost of installation.

This conclusion led them to attach more importance to the demands made on the motors and other apparatus than hitherto. It was of the utmost importance that the losses in the motors should be as small as possible, in fact, smaller than the losses in shafting, in order that the single-drive system should show an economy in power.

After years of careful investigation, which entailed heavy expenditure, the Schorch Electrical Co. have at last succeeded in placing upon the market three-phase A.C. motors having an efficiency of 85—91 per cent., according to the size of the motor, and this with varying loads which constantly arise in the driving of looms and other textile machinery.

The above fully explains the reason why the estimates of consumption received by Messrs. Buchaly & Herbertz from other sources were higher than that given by the Schorch Electrical Co., as, in the former case, the estimate included the losses in the shafting and those due to less efficient motors.

Of course, the economy due to the single-drive system can only be estimated in the case in question, as it was not possible to take actual measurements in the old works, but one may safely assume an economy of 30 per cent.

A further and most important advantage of the single-drive system is the smooth running of the machine, resulting in an increased production and a better quality in material.

In order to obtain an exact record of these conditions, the Schorch Electrical Co. carried out a series of tests on the old installation, in which the speed variations were registered.

In the illustrations given on the preceding page a few of the diagrams taken during the tests are reproduced.

The first record was made direct on the steam-engine shaft. Fig. 6 shows the diagram obtained from this test, in which speed variations of about 0·5 per cent. appear. Such variations represent normal running, so that our case is by no means a special one.

Fig. 7 shows a diagram which was taken on the shafting driving the doubling and reeling machines. The speed variations in this case amount to 3·5 per cent., and are mainly due to the starting and stopping of neighbouring machines, which cause fluctuations in the speed of the shafting. At a later date, tests were made in the new works, and the results of these are shown in fig. 8.

The tendency to-day is to run looms, doubling machines and all textile machines as fast as possible, and to approach the highest possible speed limit.

In the old mill it was necessary to keep the average speed some 2 to 3 per cent. lower than in the new mill, on account of the irregularities in the driving of the former. This alone accounts for an increase of 2 or 3 per cent. in the production of the new mill.

Further, the considerable speed variations in the old mill resulted in frequent breaking of the thread and consequently the extra attention necessary, for the machines increased the cost of production while the quality of the material with single driving was undoubtedly superior.

The advantages due to uniformity in speed are also felt in the other machines, and especially in looms.

The new mill has now been running for about one year, and results have shown that the figures given before the installation by the Schorch Electrical Co. were in every way correct. This has been extremely pronounced in the energy consumption, which came out at from 5,000 to 5,500 KW.-hours per month, or an annual consumption of about 65,000 KW.-hours.

Having regard to the above results, it need scarcely be mentioned that Messrs. Buchaly & Herbertz are well satisfied with the single-drive installation. But it may here be stated that the workpeople are also satisfied, since they have been enabled to increase their output with less labour, and have consequently increased their earnings.

Indirectly this is, of course, advantageous to the owners, as the better conditions have attracted the best workpeople to the district, and the owners are in a position to engage only reliable and skilled hands.

Not only from the owners' and workpeople's point of view, but also from the customer's, is the new installation a source of satisfaction, as a better quality of material can be obtained at a lower price.

(*To be concluded.*)

Brussels Exhibition—List of Exhibitors.— The following are included in the Official List of Exhibitors in the British Section of the Brussels Exhibition:—

Acetylene Illuminating Co., Ltd.
Applebys, Ltd.
Armstrong, Whitworth & Co., Ltd.
British Aluminium Co., Ltd.
Butler & Co., Ltd., J.
Cambridge Scientific Instrument Co., Ltd.
Campbell Gas Engine Co., Ltd.
Coalite, Ltd.
Crossley Bros., Ltd.
Darton & Co., F.
Doulton & Co., Ltd.
Dugdill & Co., John.
Fairbairn, Lawson, Combe Barbour, Ltd.
Faraday & Sons.
Fowler & Co., Ltd., John.
Gambrell Bros.
Glenboig Union Fireclay Co., Ltd.
Green & Son, Ltd., E.
Griffin & Sons, Ltd., J. J.
Holden & Brooke, Ltd.
Hopkinson & Co., Ltd., J.
Johnson Matthey & Co., Ltd.
Kelvin & James White, Ltd.
Kendall & Gent, Ltd.
Lacy-Hulbert & Co., Ltd.
Marryat & Place.
Marshall, Sons & Co., Ltd.
Massey, B. & S.
Mavor & Coulson, Ltd.
McLaren, J. & H.
Naider Bros. & Thompson, Ltd.
National Gas Engine Co., Ltd.
Negretti & Zambra.
North British Rubber Co., Ltd.
Oil and Waste Saving Machine Co., Ltd.
Parsons & Co., C. A.
Paul, R. W.
Power Gas Corporation, Ltd.
Pump and Power Co., Ltd.
Reavell & Co., Ltd.
Renold, Ltd., Hans.
Rhodes & Sons, Ltd., Joseph.
Ruston Proctor & Co., Ltd.
Shanks & Sons, Ltd., A.
Sissons Bros. & Co., Ltd.
Smith & Coventry, Ltd.
Stanley & Co., Ltd., W. F.
Sturtevant Engineering Co., Ltd.
Synchronome Co.
Underfeed Stoker Co., Ltd.
United Alkali Co., Ltd.
Walsh, John Walsh.
Waygood & Co., Ltd., R.
Weir, Ltd., G. & J.
Wellman, Seaver & Head, Ltd.

THE ELECTRICAL INSTALLATION AT THE COLLYHURST FINISHING CO.'S WORKS

A better example of the advantages of using modern plant and electric driving than is provided by the works of the Collyhurst Finishing Co., at Manchester, it would be difficult to find.

Until recently the power plant consisted of two Lancashire boilers working at 60 lb. pressure, and the machines were driven by means of steam engines scattered up and down the works, involving the use of long lengths of steam pipe and consequent heavy radiation losses.

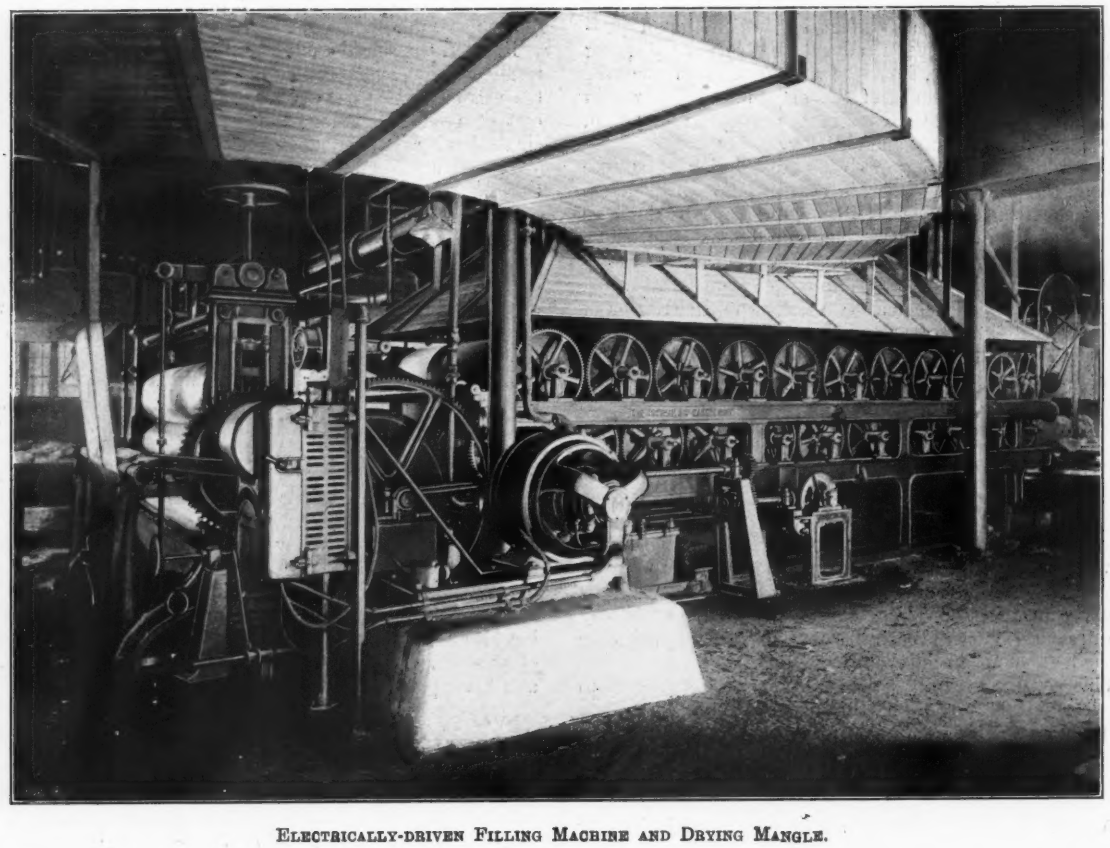
The coal used under the foregoing conditions was 200 tons per month for normal working; since the introduction of the plant described below this figure has fallen to 90 tons per month for normal working, the same class of coal at the same price still being used.

The works themselves are very conveniently arranged, there being only two storeys, comprising the stock room on the first floor, and the finishing room on the ground floor, where all the machinery is placed. The stock normally carried is about 20,000 pieces each of 80 yd. length.

Whatever pieces are required in the finishing room are sent down a shoot and delivered to one of the filling mangles and drying machines, of which there are three. These machines are each driven through spur gearing by a 15-B.H.P. motor, the speed of these motors being variable, by shunt regulation, from 300 to 1,200 R.P.M. It is interesting to note here that when the motors were first coupled on to these machines the power required was somewhat over 15 H.P., and doubts were entertained as to whether the motors would be large enough; after a few months' working the power required has now fallen to about 8 B.H.P.

After being filled (or stiffened) and dried, the material is passed on to a damping-down machine, driven from a countershaft by a 6-B.H.P. motor; thence it is transferred to one of the five calenders.

Of these calenders, one having five bowls, or rollers, is driven by a 15-B.H.P. motor running at 1,000 R.P.M., three are driven by 30-B.H.P. motors running at 800 R.P.M., and the fifth is a friction calender, to which is coupled a 40-B.H.P. motor, running at 700 R.P.M. A rather unusual feature about these motors is that there is no "off" position on the starting switches, so that they are started immediately the D.P. switch is thrown in.



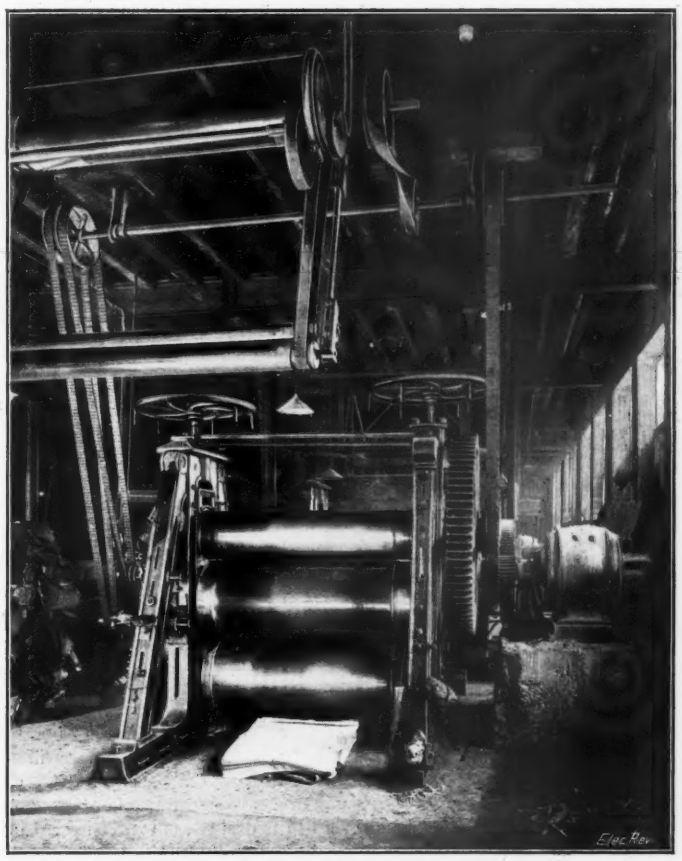
Electrically-driven Filling Machine and Drying Mangle.

After passing through the calender, the material is taken to the measuring machines, and thence to the lapping machines, on each of which 120 pieces an hour are made ready for delivery to warehouses and shops. Altogether about 70 miles of material are finished per day.

The foregoing processes constitute what is known as "finishing," and when it is stated that, owing to keen competition, it is necessary to do the whole of the work at a cost of about 8 or 10 yd. for 1d., the necessity for having an economical source of power becomes evident, since the cost of this item is one of the main factors in the case.

The steam-raising plant consists of one 30 ft. × 8 ft. Galloway boiler working at 160 lb. pressure per sq. in., and a 96-tube Green economiser, the scrapers of the latter being driven from a line shaft by the motor which drives the damping-down machines.

The electric generating plant comprises a 150-KW. 220-230-volt continuous-current compound-wound generator, with interpoles, running at 400 R.P.M., direct-coupled



Three-Bowl Calender, with Motor Drive.

to an Ashworth and Parker vertical enclosed type engine, and the necessary switchgear.

The switchboard is divided into two panels, one having the main generator switch and instruments mounted on it and the other carrying eight power circuits and one lighting circuit.

Messrs. Mather & Platt, Ltd., to whose courtesy we are indebted for many of the foregoing details, supplied and erected the generating plant and the whole of the electrical equipment. All the wiring for both lighting and power was done on insulators.

To the managers of the Collyhurst Finishing Co., Messrs. Fitch and Whittaker, under whose able direction the works have steadily grown from the possession of two small calenders to their present proportions, our best thanks are due for affording every facility for the preparation of this article.

ELECTROLYTIC BLEACHING.

By ERNEST REUSS.

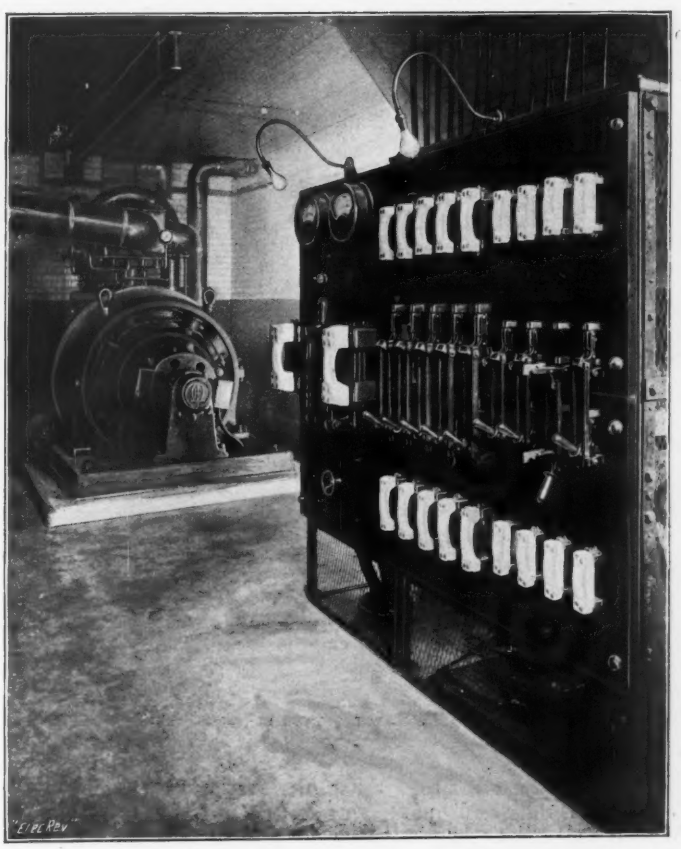
It is, perhaps, characteristic of the times we live in that we are becoming increasingly dependent upon the "clever foreigner," and this is, perhaps, more true in connection with electricity than anything else.

Electric lighting was firmly established on the Continent long before it was introduced into this country, and the economical electrical driving of mills, now successfully demonstrated and accepted here after a prolonged struggle, has long been in vogue in the leading works abroad.

Another application of electricity, and one which is making rapid strides on the Continent, is that of electrolytic bleaching. For this purpose, electricity is used in the manufacture of bleaching liquor from salt water, producing sodium hypochlorite, which is neither acid nor alkaline in character.

The cotton fibre in the raw or grey state has to be prepared for bleaching by first subjecting it to a prolonged boiling with alkalis, usually carbonate of soda, the commercial article being termed soda ash, or a mixture of soda ash and caustic soda. These extract the vegetable wax and oils by saponifying them, and loosen the colouring matter, when a thorough washing will complete that part of the process; but the material, although much lighter in colour, is not yet white—the thorough destruction of the colour can only be effected by oxidisation, either slowly, by several weeks' exposure to the sun, termed grass bleaching, or in the course of an hour or so by chemicals, the latter being the cheaper process.

Simple as the process seems, bleaching is a high art, calling for constant watchfulness and care; otherwise the material is not a full white, and, if dyed, it takes the colour irregularly, in the form of patches or streaks, or, if over bleached, it will be tender, take the dye also irregularly, and wear badly, and there will be a considerable loss in weight.



Generating Plant and Switchboard, Collyhurst Finishing Co.'s Works.

The bleaching agent hitherto in almost universal use, mainly on account of its low price and its comparative reliability in the hands of ignorant work people, has been chloride of lime, or calcium hypochlorite, which is a solution of chlorine in lime water. There are many objections, however, to its use.

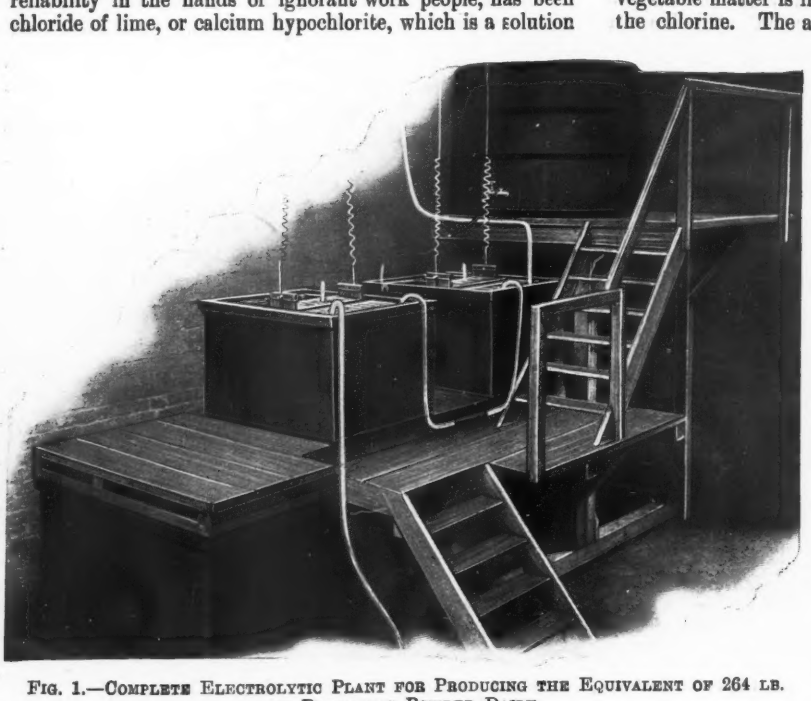


Fig. 1.—Complete Electrolytic Plant for Producing the Equivalent of 264 lb. of Bleaching Powder Daily.

In the process of bleaching, as the chlorine combines with the colouring matters, the lime present is deposited on the fibres, hindering effective penetration; the outside of the thread is well bleached, but the action is prematurely stopped by the lime, and the supply of the additional chlorine needed is checked, so that there is a liability to irregular bleaching. To counteract this, the bleach is employed stronger than is theoretically necessary.

With the electrolytic bleach, the liquor employed being only salt water, or rather, hypochlorous acid in a weak solution of soda, no deposit of an insoluble nature can take place. The liquor being neutral in this case, the chlorine is held very loosely to its base, so that immediately vegetable matter is introduced, the colouring matter attracts the chlorine. The action is not altogether spontaneous, the operation lasting about half an hour, according to the nature of the material and the thoroughness or otherwise of the boiling process. The action proceeds much more regularly, equally and rapidly with nascent electrolytic hypochlorite than is the case with bleaching-powder solution, where the process is accompanied by a precipitation of lime.

Where bleaching powder has been used, the lime must be removed by dissolving it out of the cloth again with acid. Hydrochloric acid must be employed for this purpose, although sulphuric acid would give a better white. It cannot be used, however, as the sulphuric acid, combining with the lime, would form an insoluble compound—sulphate of lime. This is another point of advantage possessed by electrolytic sodium hypochlorite, as it permits of the use of sulphuric acid.

Apart from clearing the lime, acids quickly remove the smell of chlorine, and, where no lime is present, the barest trace suffices, with the advantage that far less washing is called for. The use of acids, however, hardens cloth, and where a soft, silky finish is desired, it is preferable to omit it where electrolytic sodium hypochlorite is employed.

There is less loss of weight by the electrolytic bleach, and, as the goods have been better penetrated by the bleaching agent, provided that the boiling has been effective, goods kept in stock are not so liable to turn yellow.

Probably one of the greatest advantages attending the use of electrolytic bleach is its regularity of strength. The salt and water are mixed by measure, and the

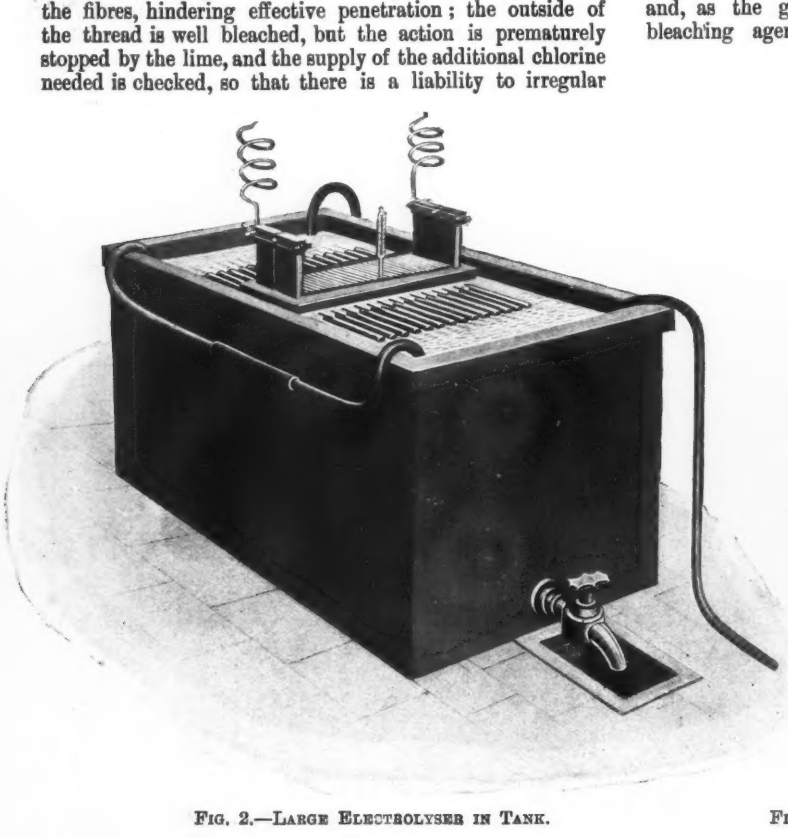


Fig. 2.—Large Electrolyser in Tank.

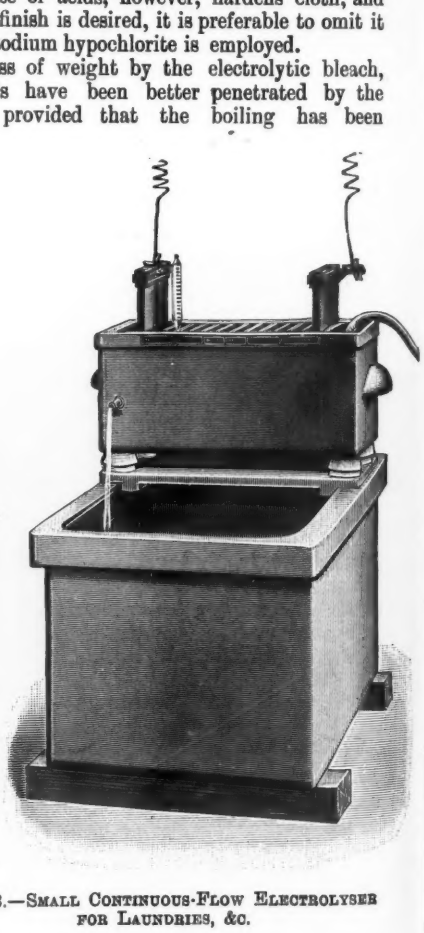


Fig. 3.—Small Continuous-Flow Electrolyser for Laundries, &c.

resultant brine is tested with a hydrometer. It is then run into the electrolyser and the electricity is switched on. An ammeter indicates the current passing, and if the brine is too weak or too strong the error is at once detected. The passage of the current raises the temperature of the brine, the stronger the salt water the greater the rise, and *vice versa*; the temperature is recorded by a thermometer placed in one of the cells, so that there are in all three checks. Provided the brine is of correct density, at the end of the appointed time the bleach will be uniformly of standard strength.

It may be mentioned that electrolytic bleaching is almost universally employed in one of the newest industries —*i.e.*, the manufacture of artificial silk—over twelve firms using it. This is explained by the fact that the chemists in charge, having had a scientific education and being untrammelled by ancient prejudices, naturally selected the most reliable bleaching agent. There is also a further reason: artificial silk in a wet state is very delicate, and this is a further tribute to the value of the electrolytic bleach.

An electrolytic bleaching plant consists of brine dissolver, electrolyser and storage tank for the bleach, as shown in fig. 1 on the preceding page.

It may here be stated that there are several systems of electrolysers in the market; they may be roughly classed in two groups: those employing carbon for the electrodes, and those in which fine platinum wire or foil is used. Makers of the latter system claim a rather better efficiency for their apparatus, but against this must be set the enormous price of platinum and its great liability to damage when the apparatus is periodically cleaned out to remove the calcium and magnesium deposits, which would otherwise seriously affect the working.

The low price of carbon electrodes, and their ability to withstand the rough usage consequent on cleaning, has led to this system being given the preference. We, therefore, give a short description of this apparatus, as made by Messrs. Ernest Grether & Co., of Manchester.

The electrolyser (fig. 2) consists of a rectangular stoneware box divided by the carbons into some 30 compartments, each chamber having a hole at the bottom and another at the side, about 2 in. from the top; the first and last carbons in the set form respectively the anode and cathode.

The electrolyser is placed in a stoneware tank, measuring about 6 ft. long × 4 ft. wide and 3 ft. deep, and this is filled with brine, holding about 15 per cent. of common salt in solution. As soon as the circuit is completed, a lively effervescence commences in the cells, due to the evolution of hydrogen, which raises the level of the liquid inside the electrolyser, causing it to overflow through the openings at the sides, while it is replaced by fresh liquor entering through the holes in the bottom.

As the passage of the current engenders heat, the temperature is kept down by passing cold water through coils placed on either side of the electrolyser. The circulation is entirely automatic and very effective.

Continuous current is employed, at about 80 amperes, 110 volts, and it requires some 10 hours to complete the electrolysis; thus about 88 KW.-hours of energy are consumed, the output in chlorine at the end of the operation being 10·5 kg., or the equivalent of about 80 lb. of bleaching powder.

The cost of the electric bleach is not greatly in excess of that of bleaching powder; it does fully 15 per cent. more work, and there are other economies and advantages which combine to render the electric bleach the cheaper, as well as the more desirable, in actual use.

It is, however, not so much the question of price which is bringing electrolytic bleaching to the front, because the cost of chlorine to bleach a ton of cloth is trivial, but the fact that it has distinct advantages of its own, which, as in the case of other applications of electricity, are only really appreciated after they have been well tried. In Germany, where the system has been for some years before the public, the last two years have seen a very rapid increase in its popularity.

Although we have selected cotton fabrics by way of illustration, the electrolytic bleach is also employed for bleaching paper, linen and jute. For the two fibres last-named it stands pre-eminent, as they stand the action of bleaching powder badly, being rendered harsh, brittle and non-lustrous.

For laundry work the electrolytic bleach is making great strides, to the great advantage of the public. It reduces the work of the rotary washer by one-half, thus diminishing the baneful grinding and pounding, and brings up the linen as white as when new. The Americans were quick to appreciate its advantages. In the two years that the apparatus

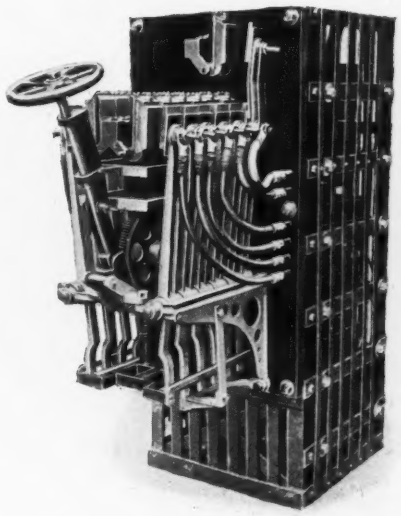


Fig. 1.—Premier Electric Control's Multiple Lever Motor Starter (See p. 606).

has been built there, 150 laundries have adopted it. It is in use also in the laundries of the whole of the German passenger steamer service. A small electrolyser for this class of work is shown in fig. 3, p. 604.

For sanitary work, sterilising infected clothing, drains, &c., the electrolytic liquor is unrivalled and without a drawback. It destroys bacteria and the germs of phthisis, yellow fever, typhus and anthrax, and, unlike chloride of lime

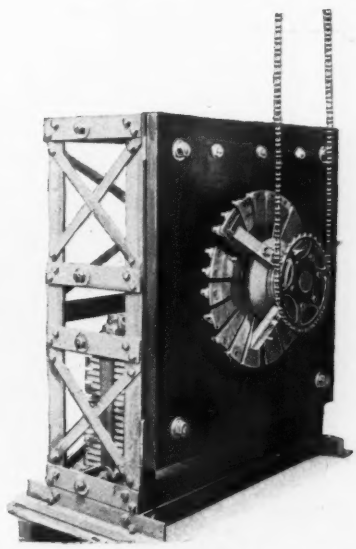


Fig. 2.—Premier Electric Control's Three-Phase Rheostat.

and the various disinfecting powders, it does not choke up the drains. It is also non-poisonous.

The latest application of electrolytic liquor is to the treatment of woollen hosiery, German chemists having discovered that a weak solution renders these unshrinkable.

Owing to the passing of the new Patent Act, this electrolyser is now built in England.

APPARATUS FOR TEXTILE FACTORIES

Premier Electric Control, Ltd.

We recently visited the works of this company in Clerkenwell to inspect some very heavy starting switches of the multiple-lever type, of which they have supplied nearly a score to the London County Council Tramways Department for starting motor-generators. Our readers are familiar with the solenoid starting switch of this company, in which a series of switches are closed in succession by a solenoid acting upon a number of bent levers of graduated length. In the hand-operated switches here referred to, a similar action is employed, as will be seen in fig. 1 (page 605). The hand-wheel actuates a worm, which is brought into gear with the wheel by pushing the hand-wheel forward; the hand-wheel is then rotated, and causes a camming frame to rise, fitted with rollers which act on the bent levers, bringing the switches into action consecutively.

The arms of the switches have a long leverage, so that each contact is made quite quickly, and the carbon contact blocks, which are very substantial, are freely mounted, so that they adjust themselves to one another perfectly. Flexible straps of copper gauze are used to carry the current from the loose blocks. When all the resistance steps have been cut out, the whole of the switches are short-circuited by a main switch, shown in the illustration as being similar in type to the rest, but in the latest pattern made of the laminated copper type. When this is closed the whole set of levers are held in contact by an electromagnet which holds the worm in mesh with the worm-wheel. Should the current fail, the worm is released and falls away out of gear, and the whole of the switches open in rapid succession. The illustration shows the switch combined with the starting resistances, which are enclosed in an iron framework. The construction of the whole apparatus is very substantial, and designed to withstand hard usage. The starter illustrated is capable of carrying a maximum current of 600 amperes.

Fig. 2 (page 605) shows a three-phase rotor resistance switch by the same firm, with copper brush contacts, actuated by a sprocket wheel and chain from an overhead gallery. In this case also the resistances are shown mounted behind the switch. A large variety of starting rheostats, automatic and otherwise, was in course of construction in the company's workshops, many of the apparatus embodying useful features of their own invention.

Balcke & Co., Ltd.

Natural-draught cooling towers of the "chimney" type, first introduced by Messrs. Balcke & Co. in 1894, are in use at very many British electricity works, and have been brought to a high degree of perfection. The design of such towers, in order to secure the best results, is no simple matter, for it is not so easy to ensure that the falling water shall be finely divided into drops and films throughout its descent as it might appear at first sight, and, on the other hand, care must be taken that the baffles and troughs employed for this purpose shall not unduly impede the ascending

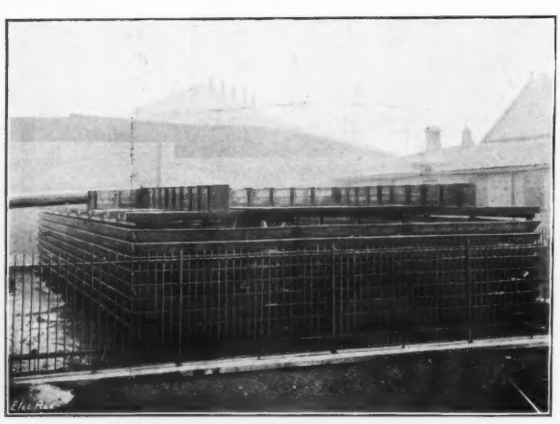


Fig. 3.—Balcke Open Type Cooling Tower at Preston.

current of air. An important advantage of the chimney type, in populous neighbourhoods, is that it delivers the moisture-laden air at a considerable height, so as to minimise annoyance to the residents through the emission of vapour. In the case of many works, however, where ample space is available, and the vapour is not likely to cause annoyance, the open type of cooler may be employed, in which reliance is placed upon natural air currents; the accompanying illustration shows one of these, recently installed at Messrs. W. H. Hincksman's cotton mill, Croft Street, Preston. Most cotton mills are provided with a cooling pond or "lodge," but this, unless of very large area, is a very inadequate and inefficient means of cooling the circulating water, especially in warm weather, and the consequence is that a poor vacuum is obtained. By the adoption of a cooler such as that illustrated, a great improvement in this respect can be effected at very moderate cost. In the case in question, the difficulty experienced in cooling the water was solved by the erection of the tower illustrated, which was British-made throughout, like all the towers now supplied by Messrs. Balcke & Co., Ltd., in this country. A point worthy of consideration in this connection, is the great reduction in the space required for a given result; thus, a mill engine of 1,000 I.H.P. requires a lodge having an area of 30,000 or 40,000 sq. ft., whereas with a cooling tower, 800 to 1,400 sq. ft. suffices, setting free the rest of the space for more profitable utilisation. The open type of tower is also suitable for erection upon the roof of a building, if no other space is available.

Thomas Broadbent & Sons, Ltd.

The peculiar appropriateness of electrical driving for hydro-extractors has enabled Messrs. Thos. Broadbent to place on the market machines which are *par excellence* the ideal apparatus for drying cotton and woollen fabrics in dyeing, bleaching and finishing works. The whole machine is designed essentially for its purpose, the electric motor forming an integral part of it. The mode in which this is done is well shown in the sectional view, fig. 5, of the

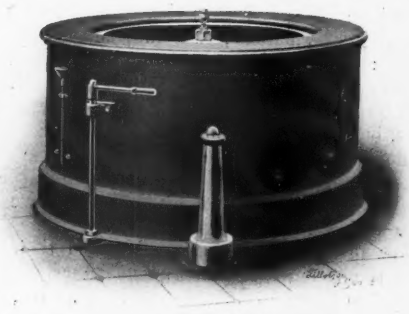
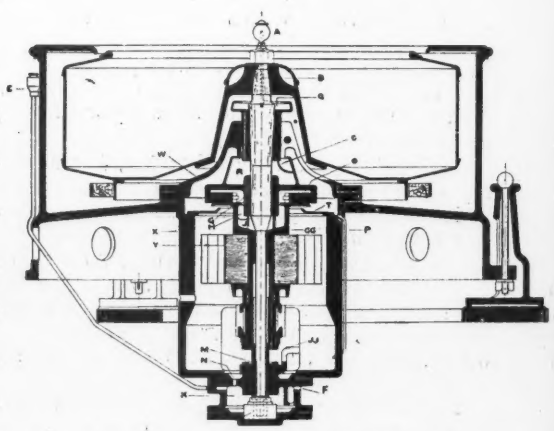


Fig. 4.—Suspended Electrically-Driven Hydro-Extractor.

hydro-extractor, illustrated in its complete form in fig. 4. It will be seen that the armature is mounted upon the centre spindle which carries the basket, and the field magnets form part of the frame of the machine, the whole of the windings and the commutator being completely enclosed in an iron casing excluding water and oil.



A, Lubricator; B, Oil channel in spindle; C, E, Oil pipes; F, N, P, Oil drains; G, Q, Oil channels; GG, Armature sleeve; H, J, K, M, R, Oil chambers; JJ, Rocker for brush gear; O, Driving shoes; T, Cover plate for motor; V, Ball bearing; W, Centrepiece top; X, Motor magnet frame; Y, Armature core.

Fig. 5.—Section of D.C. Hydro-Extractor.

The armature is carried upon a sleeve revolving on the centre spindle, and the upper part of the sleeve carries friction shoes, which are thrown out by centrifrugal force when the armature is set in motion; by this means the extractor is brought up to speed gradually, and without imposing an excessive load upon the armature at any time. As all the moving parts are rotary, the machine runs smoothly and noiselessly, and a patent system of lubrication is provided, which automatically ensures the presence of a film of oil between the wearing surfaces.

Fig. 6 shows the type of motor employed when the supply is three-phase alternating; the mechanical parts are the same as when a D.C. motor is used. Starting in this case is effected

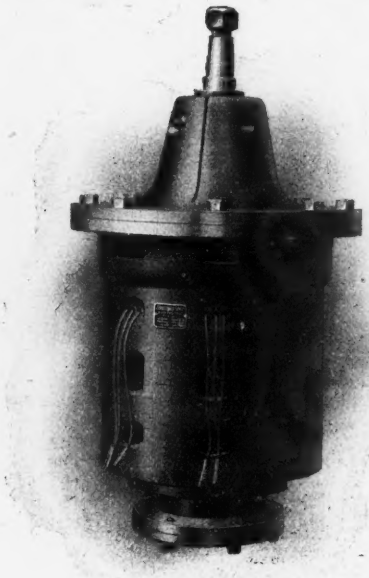


Fig. 6.—A.C. Motor for Broadbent Hydro-Extractor.

with a Y connection of the stator winding, which is altered to Δ when full speed is attained. Two-phase and single-phase motors are also supplied.

Matthews & Yates, Ltd.

The increasing demand for electric motors has encouraged numerous firms to take up their manufacture. Amongst the first to do this were Messrs. Matthews & Yates, Ltd., of Cyclone Works, Swinton, Manchester, who used their motors principally in connection with their well-known Cyclone fans. Recently, however, they have placed on the market their latest pattern, which is highly

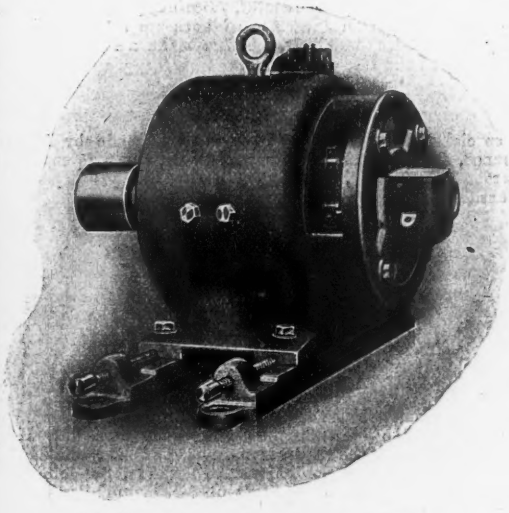


Fig. 7.—Matthews & Yates D.C. Motor.

suitable for use as an independent motor. It is rated for continuous running, being efficiently and compactly designed for severe service, and the whole of the windings are on the former principle. It is shown in fig. 7.

This motor is also combined with the firm's fans, which are widely used for all kinds of ventilation, and particularly in connection with textile processes.

To meet the Home Office regulations recently issued, Messrs. Matthews & Yates have designed a special plant known as the Cyclone dust-collecting plant, which has been installed with great success, principally in Ireland and Scotland.

The apparatus consists of one or more Cyclone blowers and exhausters (according to the size of the plant), which are combined with the motor above-mentioned, and their lately patented battery of Cyclone dust separators. These are connected to the machines giving off the dust by means of hoods, hoppers and trunking, through which the dust is sucked from the carding, winding, or doubling machines by the blower and exhauster, fig. 8, which then delivers the air into the separators, where, by centrifugal action, the solid matter is deposited in a chamber prepared to receive it, whilst the cleaned air is allowed to go freely into the atmosphere at the top.

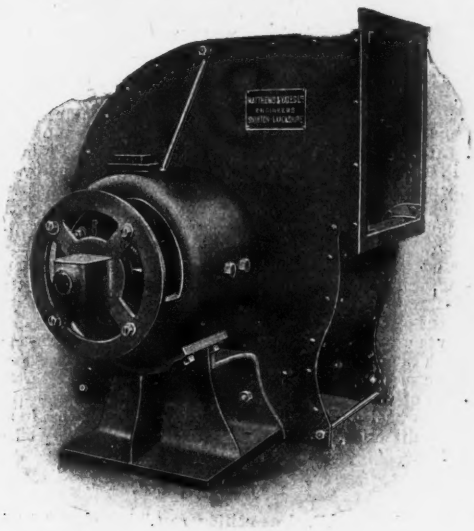


Fig. 8.—Cyclone Blower.

It will readily be seen that by this arrangement the rooms where the operatives are at work are kept free from dust and well ventilated, as the fans are constantly changing the air in the room.

Another of the firm's specialities is the Cyclone humidifier, which combines an efficient system of humidifying with ventilation, and hundreds of these plants have been satisfactorily installed all over the British Isles.

Induced draught for boilers is also an important line with Messrs. Matthews & Yates, Ltd., their fans being particularly adapted for this class of work; they are substantially constructed, and highly efficient.

T. W. Broadbent, Ltd.

With a view to meeting the demand for electrical machinery for industrial purposes, Messrs. T. W. Broadbent have recently introduced a line of small polyphase alternators, of 60, 80, 100 and 150 kw. sizes.

These machines are of the rotating field type, with laminated cores and poles, and are arranged for the stators to be drawn to one side to allow of inspection of the rotor and stator coils. Small

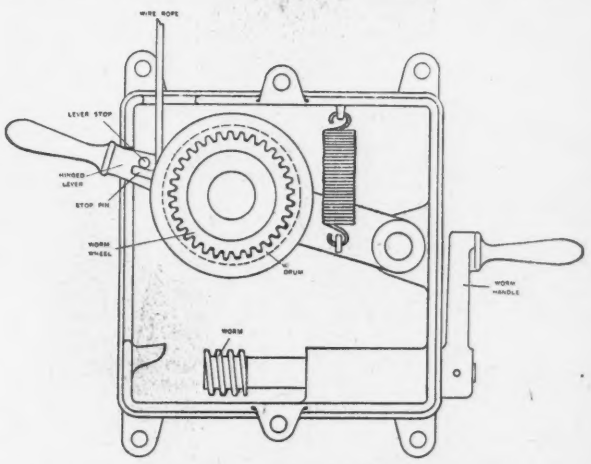


Fig 9.—Improved Motor Starter (T. W. Broadbent).

exciters are direct-coupled to the machines, which are intended for mixed power and lighting work with a power factor of 80 per cent. or 90 per cent.

In the matter of 440-volt motors, with commutating poles, improved ventilation is now provided; in the larger sizes the ventilating ducts of the armature continue through the commutator, and another feature is the comparatively large clearance allowed, which gives increased safety in operation.

The firm are also bringing out a line of squirrel-cage motors of somewhat higher speed than those previously listed, and these will be insulated with specially selected materials; they are intended to meet the demand for a serviceable and efficient motor of moderate cost.

Messrs. Broadbent have recently introduced an improvement on their slow motion motor-starters, with which, as ordinarily constructed, there is a tendency for the brushes and first contacts of the starters to burn, owing to the large rush of current when the brushes meet the first contact—with only a very small contact area. This trouble occurs from the very fact of the slowness of the motion. What is required is a winch gear that will carry the brushes of the starter fully on to the first contacts with a quick positive action, and then continue the movement over the contacts *slowly*. This is accomplished in the firm's new winch gear, shown in fig. 9, p. 607. It will be noticed that the switch-arm is actuated by means of a wire rope, which winds on to the drum of the winch gear. Attached to the drum, and revolving on the same spindle with it, is a worm-wheel, and the spindle is carried by a hinged lever, with a projecting handle. The wire rope is adjustable to such a length that the starter is in the off position when the lever of the winch is up in the position shown. To switch on, the attendant pulls down the lever of the winch, and, as the drum is prevented from turning in a clockwise direction by means of its stop-pin, which engages with another stop on the lever itself, the switch-arm of the starter is pulled over to the extent of the movement of the winch lever (*i.e.*, the winch is adjusted so that the movement of the lever necessary to bring the worm-wheel into gear with the worm is just sufficient to pull the switch-arm on to the first contacts). The attendant then winds on the starter slowly by means of the worm handle at the right-hand of the winch box, the worm wheel and winch drum being thus rotated in a contrs-clockwise direction. These starters have proved very effective in service.

Loxley & Co., Ltd.

The combined "V.B. cleat ceiling rose," introduced by Messrs. Loxley & Co., which we described in our issue of March 4th, p. 371, is particularly well adapted for use in the lighting of textile mills, and has been successfully adopted for that purpose. This class of wiring is simple in lay-out and uniform in character, so that a remarkably low cost per point can be attained, and the adoption of a time-saving device such as that above-mentioned ought to be of great assistance in facilitating the wiring of mills quickly and cheaply.

Tetley & Co.

A neat line of liquid motor starters is being introduced by Messrs. Tetley & Co., suitable for use in textile factories—where a number of them have already been installed, in Lancashire. They are made for both d.c. and a.c., in sizes from 12 to 800 h.p. at voltages up to 800 volts. As the figures show, the liquid resistances are mounted in a covered frame on four feet, and are operated with a hand-wheel and worm gear, ensuring slow motion; these

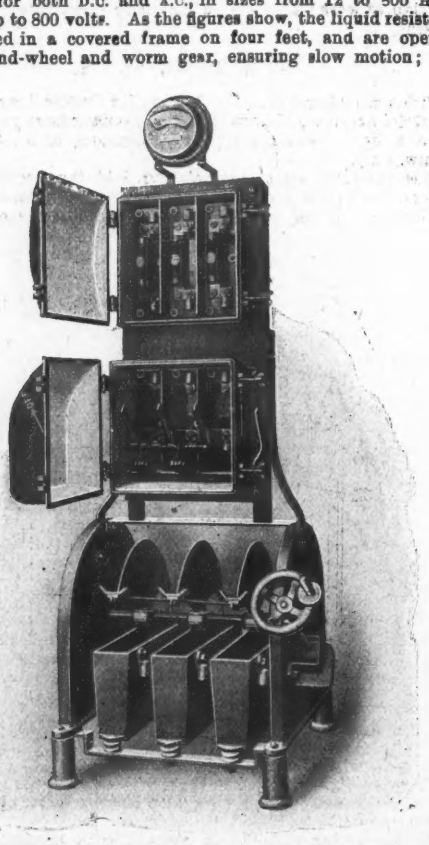


Fig. 10.—"Falcon" Three-Phase Liquid Starter with Knife Switches and Fuses, Open.

resistances may be had by themselves, but are preferably accompanied by switches, fuses and an ammeter, mounted on the top of the starter as illustrated. Fig. 10 shows a three-phase panel with knife switches and cartridge fuses, with the various compartments opened; a similar equipment is made, fig. 11, with a triple-pole oil switch, either non-automatic and fitted with fuses, or provided with overload release on each phase, or overload on two phases and no-volt on the third, as required.

The firm also make a liquid starter, a.c. and d.c., specially designed for use in textile mills where the starters are fixed in

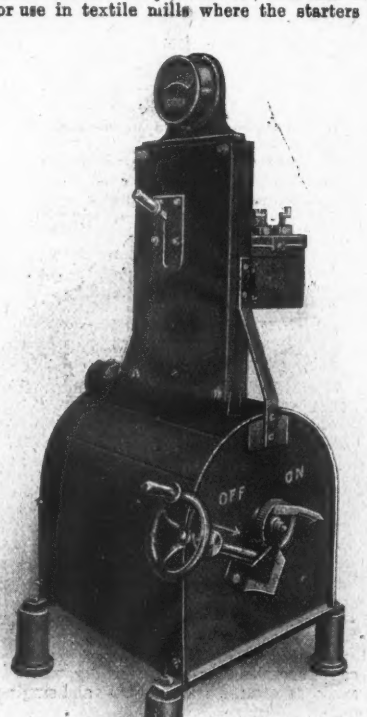


Fig. 11.—"Falcon" Starter with Oil Switches, Closed.

towers; these are provided with a device which, on the interruption of the main circuit from any cause, removes the blades from the liquid, so that the circuit cannot be restored with no resistance in circuit with the motor. Brushes are provided which short-circuit the resistance when the blades are fuily inserted in the liquid. Besides these lines, the firm make a large variety of ironclad switch and fuse gear.

Cryselco, Ltd.

A special type of metal-filament lamp is made by Messrs Cryselco, Ltd., for use in textile factories, which is capable of withstanding vioration, and gives a quality of light very suitable for textile work

NOTES.

(*Concluded from page 594.*)

The Engineers-in-Charge Annual Dinner.—The 15th annual dinner of the Association of Engineers-in-Charge was held at the Holborn Restaurant on Saturday last. Mr. Henry Adams, President of the Association, was in the chair, and amongst those present were the Lord Mayor of London, Sir John Knill, Sir Alexander Kennedy, Judge Rentoul, Sir David Gill, Dr. Glazebrook, Mr. W H. Booth, Mr. F Broadbent, Mr. H. W. Handcock, Mr. R. J. Wallis-Jones, and about 300 members of the Association. An excellent musical selection was given by Mr. George Hardy's Bijou Orchestra during dinner.

After the usual loyal toasts, Mr. H. W. Handcock proposed the toast of "The Association." He pointed out the need for careful and efficient engineering training; in his opinion simple apprenticeship on the one hand, or technical instruction on the other, was not sufficient. It was necessary to have both, and he suggested two years' work in the shops before the granting of any engineering diplomas. Membership of the Association was, to a great extent, the hall-mark of the qualifications of its members, and he hoped that in time to come the Association might grant certificates of capability to take charge of and run engineering undertakings on land, in exactly the same way that the Board of Trade certificate was granted to engineers to take charge of marine plant. The toast was replied to by the president, Mr. Henry Adams, who humorously remarked that the engineer-in-charge might often be said to be in charge of the failures in design and workmanship made by other engineers, a hit which was thoroughly appreciated. He referred to the honour paid to the Association by

the presence of the Lord Mayor, hinting that it was probably partly due to the fact that practically all those present were properly-trained men who had learnt their business during a stated term of apprenticeship. The necessity for such training was illustrated by several instances of amusing mistakes made by ignorant men who had by some means been placed in charge of valuable machinery which they did not in the least understand.

The health of "The Lord Mayor, Sheriffs and Corporation of the City of London" was proposed by Sir Alexander Kennedy, who referred to his apprenticeship of five years at Millwall, and emphasised the value of such a definite period of practical training. He pointed out that in the engineering profession the apprenticeship system had been more generally retained than in other industries, and reminded those present of the fact that an influential committee who recently considered the question of the best training for engineers, came to the conclusion that practical workshop experience was a most important factor in any system of engineering education. He suggested that amongst the organised workers in the engineering trades of this country there should arise an ambition, not merely to secure short hours of labour and high rates of wages, but to obtain the best training for their calling and to do the best work. If Trade Union leaders worked for this ideal, they would find that their members would be the very best paid workmen in the whole world. The Lord Mayor, Sir John Knill, Bart., in thanking Sir Alexander Kennedy for the manner in which he had proposed his health, urged the importance of the revival of the old system of apprenticeship, which, in his opinion, was an essential part of the training of those who were to take charge of the valuable machinery installed in public institutions.

"Our Guests and Friends" was proposed by Mr. W. H. Patchell, in the absence, through illness, of Mr. James Swinburne, and was responded to by his Honour Judge Rentoul and Sir David Gill. The toast of "The President" was proposed by Mr. A. E. Penn. The large audience appreciated the sentiments of the various speakers, and thoroughly enjoyed the musical programme, which was interspersed among the speeches. The present influential position of the Association is largely due to the energetic manner in which Mr. H. Capsey, the hon. secretary, has performed his duties, and it was pleasing to note the esteem with which he is evidently regarded by his fellow members.

London Chamber of Commerce Electrical Section.—At the annual meeting of the London Chamber of Commerce, on April 7th, the Electrical Trades Section presented their report, which stated that the Section at their annual meeting had re-elected Mr. C. P. Sparks as chairman, and Mr. W. J. Madgen as deputy-chairman. In regard to electricity in factories, as the Home Secretary, in issuing the regulations, did not adopt all the recommendations made by the Commissioner including that headed "Arbitration, Appeal or other Protection," the Home Office were approached with a view to receiving a deputation on this matter, but finding the Department were unable to take any steps until the general law had been amended, it was not found possible to take any further action. Members were therefore advised that the only further precaution that could be taken was to apply for exemption in those cases, at any rate, where there was a difficulty in applying the regulations. Such exemptions could be obtained under exemption No. 6, which states "The Secretary of State may, if satisfied that safety is otherwise practically secured, or that exemption is necessary on the ground of emergency or special circumstances, grant such exemption by order, subject to any conditions that may be prescribed therein; and may revoke such order." In regard to electricity in mines and the appointment of a Departmental Committee, a communication was addressed to the Home Office suggesting that there should be a representative of electrical manufacturers and electric supply manufacturers to advise more particularly on the commercial aspects of the regulations. A considerable amount of support was received from various Chambers of Commerce. The Committee appointed by the Home Office was small, but met with the approval of the electrical industry. The Section considered the advisability of arranging for a witness to give evidence as to the working of the existing special rules for the use of electricity in mines, but up to the end of the year a witness had not been secured, and further steps were being taken in this direction. The Section considered the question of the installation of wireless telegraphy on passenger ships, and a resolution was unanimously passed to the effect that it was advisable that all passenger ships for oversea traffic should be fitted with wireless telegraphy. The Council of the Chamber was requested to urge His Majesty's Government to introduce a Bill requiring that all such passenger ships should be so fitted. The Section approved of the action of the manufacturers' section in opposing the proposal of the London County Council to promote legislation to delete the word "black" from the Clause in the Public Health Act, 1891, which provides that "any chimney (not being the chimney of a private dwelling house) sending forth black smoke in such quantities as to be a nuisance, shall be a nuisance to be dealt with summarily under the Act." It was reported to the Section that the Council had appointed a Special Committee in connection with the question of misrepresentation in trade, and would be willing to receive suggestions as to any points affecting electrical manufacturers, which might usefully be brought before the Committee. Mr. Leon Gaster was appointed to give evidence on behalf of the Section before the Special Committee. Other matters considered by the Section included the question of co-operation on matters of common interest between various institutions and associations, but pending inquiries as to the scope and possibility of such co-operation, the matter was deferred.

Institution and Lecture Notes.—North of England Institute of Mining and Mechanical Engineers.—At Newcastle on Saturday a paper was read by Dr. W. M. Thornton and Mr. E. Bowden, B.Sc., of the Armstrong College, on the ignition of coal dust by single electric flashes. The lecturers pointed out that coal dust, although an insulator of electricity when dry, became a conductor when wet. The necessity for keeping commutators clean was obvious. There appeared to be no danger of flashing over on 480 volts between live parts 1¼ in. apart, unless the deposit of dust was entirely conducting as from carbon brushes. Distributing boxes should be dust and flame-tight, and in compartments, so that the main terminals could not be short-circuited by a flash; cartridge fuses should be used where possible, and once used should not be replaced by bare wire or by running wire through an empty tube. Although it had been shown that a cloud of coal dust could be ignited by small single flashes, it did not follow that the use of electricity in collieries was dangerous. Electricity was not more dangerous than the supply for domestic use of highly poisonous and explosive coal gas. An efficient leakage indicator was equally necessary for both.

Faraday Society.—A general discussion on "The Constitution of Water" will be held on Tuesday, April 26th, to be opened by Prof. Walden, of Riga, followed by the reading of short papers. In connection with the discussion, and particularly in honour of Prof. Walden, a dinner of the Society will be held on the following evening, Wednesday, April 27th, at the Trocadero Restaurant, W. The President, Mr. James Swinburne, F.R.S., will preside, and among those who have signified their intention of being present are Prof. Walden, Prof. Guye, Sir William Ramsay and Prof. James Walker.

Institution of Electrical Engineers (Manchester Students' Section).—The second supper and smoking concert of the session was held at the Grand Hotel, Manchester, on Tuesday, the 5th inst. Mr. L. H. A. Carr, the hon. sec., presided in the absence of the chairman, and about 50 members and friends were present.

The Institution of Mining Electrical Engineers (Newcastle Branch).—On Saturday, May 14th, with the permission of the Newcastle-upon-Tyne Electric Supply Co., Ltd., arrangements have been made for the members of the Newcastle Branch of the Institution of Mining Electrical Engineers to inspect the electrical plant at the Carville power station, Wallsend-on-Tyne. Members meet at the power station not later than 2.30 o'clock. On Saturday, June 11th, the members of the same Branch will hold a picnic at Fountains Abbey, Ripon. Full particulars will be forwarded to each member in due course, and it is hoped that as many as possible will avail themselves of the opportunity of joining the excursion.

Junior Institution of Engineers.—At the last meeting of this Institution a paper on "The Transmission of Power by Belts" was read by Mr. R. F. Krall, Assoc.M.Inst.C.E. After observations on belt driving in general, the author described a system of driving by means of thin steel belt, the material being specially manufactured and of very high temper, which is being extended in Germany and Belgium. Another form of belt driving, in which belts in common use are employed, the invention of Capt. Leneveu, a French Artillery officer, and known as the "Lenix" system, was then described. The essential feature of the Lenix system was a pulley freely floating on the belt, being mounted on an arm with adjustable counter-weight, and placed very near to the belt pulley, and the arm capable of moving about the centre of the belt pulley.

L.G.B. Inquiry at Radcliffe.—This inquiry was continued until Saturday afternoon last, and adjourned until to-morrow, when counsel will make their speeches at the Arbitrator's chambers. Evidence was given by Mr. Gripper, managing director of the Power Co., as to its financial position; Mr. J. L. Rushton, of Dobson and Barlow, said his firm had built works just outside Radcliffe, because they could obtain cheap power there from the company; and Mr. C. D. Taite, engineer to the Power Co., gave some details of the bulk supply operations of the company, and it was contended that the interests of the Council would be served by taking such a supply from the company, rather than extending its own works.

The Caloriser.—A demonstration was given on Monday, April 11th, at the Hythe Road Works, Willesden, of the Caloriser, an appliance of Smoke Consumption, Ltd., based on the principle of temperature conservation so long advocated in these columns. The Caloriser, as applied to an internally fired boiler, consists of a lining of a certain tile of mixed fireclay and refractory matter. These tiles are baked in quadrant form and used to line the furnace tube several feet beyond the bridge, with the object of preserving the temperature of the coal gases to at least 700° C. = 1,292° F. A mixture of very small coal was used—some of it was Welsh, the remainder a smoky Midland coal; there was a slight air admission at the bridge, and the smoke given off at firing was of brief duration. The system is based on correct principles, but the particular furnace to which it was applied would, we think, have been improved by more liberal air provision at the door. The draught also was given by a very low chimney, and was very poor.

It is satisfactory to note that the company encase at least some of the cross-water pipes in thin refractory tiles so as to cut out the chilling effect of these needless obstructions. The effect of the Caloriser tiles is, of course, to absorb heat when the fire is clear and bright, and to give it out when the fire becomes colder and is giving off hydro-carbon gas.

As we have so often said, the essentials of perfect combustion of the bituminous "smoke" gases are a furnace of proper form, an admixture of air with the crude gases, space for uninterrupted combustion of this mixture and prevention of heat loss to the boiler while combustion is in progress. This temperature the company give as 1,300° F., and they seek to obtain it by thin refractory tiles. They also have a very ingenious regulator for air admission after stoking. It consists of an oil seal box through which air travels to the furnace. The seal is lowered by raising out of it, when the fire-door is shut, a pot of oil. This leaves the seal open and air rushes through. But the oil pot has a leak hole in it, and this leak gradually re-establishes the seal and quickly shuts off the air supply as the smoke of the fresh charge of fuel falls to nothing. When the fire is next charged the opening of the door dips the pot into the oil, and it is again raised and the seal opened when the fire door is again closed. Particluars may be had from Smoke Consumption, Ltd., 120, Fenchurch Street, E.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

General.—Mr. F. R. Davenport has resigned his seat on the board of Peter Brotherhood, Ltd., and joined the directorate of Messrs. Willans & Robinson, Rugby.

Mr. Justus Eck, engineer-in-chief to the Union Electric Co., Ltd., of Park Street, Southwark, sailed on April 9th by the ss. *Lusitania* for New York, with the intention of visiting the principal cities of the United States for the purpose of studying the latest American developments in street, shop and railway lighting, and in the applications of electricity to manufacturing and mining.

Mr. W. Smith, who has been chief clerk and cashier in the Fleetwood District Council's Electricity Department, and who is leaving Fleetwood for Liverpool, has been presented by the staff of the Electricity Works with a smoker's cabinet.

The King has authorised Mr. William Bullard, manager of the Eastern Extension Telegraph Co. at Shanghai, to accept and wear the Insignia of the Third Class of the First Division of the Imperial Order of the Double Dragon, conferred upon him by the Emperor of China, in recognition of valuable services rendered by him.

Mr. J. E. Kingsbury announces the change in his address from Norfolk House, Victoria Embankment, to 7, Serjeants' Inn, Temple, London, E.C. Telephone No. Central 2,418. Telegraphic address, "Rexinter, London."

Dr. J. Erskine-Murray asks us to state that the rumour that he has been appointed technical adviser to a wireless syndicate is untrue, and calculated to injure his position as an independent consultant. He has no pecuniary connection with, or interest in, any particular system, his relations with all his clients being on the same basis, namely, that of an occasional consultant.

Mr. Albert Auer has commenced to practise in Aberdeen as a consulting electrical engineer. For the last 9½ years he has been with the Aberdeen Electrical Engineering Co., Ltd. He desires to receive lists from makers of electrical apparatus, accessories, &c.

Tramway Officials.—On April 1st Mr. G. F. Craven, chief assistant tramways engineer to the Reading Corporation, was the recipient of a silver tea and coffee service from the employés and staff of the Tramways Department, as a mark of esteem and good wishes on his approaching marriage. The general manager, Mr. W. Binns, made the presentation.

The Liverpool T.C. has been recommended to increase the salary of Mr. C. W. Mallins, general manager of the tramways, from £850 to £1,000 per annum.

Central Station Officials.—The staff at the Gravesend Corporation Electricity Works have presented a walking stick to Mr. P. W. Naylor, who is leaving after 6½ years' service at the works.

Mr. W. H. Hall, late borough electrical engineer at Morecambe, has been presented by the borough officials with a kit bag.

The Rochdale Town Council has increased the salary of Mr. C. C. Atchison, borough electrical engineer, from £350 to £400 per annum.

Mr. E. S. Taylor, of the Watford undertaking, has resigned, having received another appointment. Mr. J. E. Walley, engineer-in-charge, has been appointed to the vacant position at a salary of £110 per annum, rising by annual increments of £10 to £130. Mr. R. S. Savory (improver) has been appointed assistant mains superintendent, and Mr. J. B. Dent has been appointed engineer-in-charge.

Mr. W. B. Adams, A.M.I.E.E., having resigned the position of engineer-in-charge at the Borough of St. Marylebone Generating Station, was on Tuesday last presented by the staff with a spirit tantalus. Mr. Adams left on Thursday for Spain, having accepted an appointment with the Rio Tinto Co.

The staff and employés of the Swindon Corporation Electricity and Tramways Department held a smoking concert last Saturday evening, when they presented Mr. R. W. Grubb with a pair of silver salt cellars and pepper duster, tobacco pouch and steel pocket tape, on the occasion of his departure for Dewsbury.

The Sheffield Town Council has appointed Mr. H. G. Bennett, motor canvassing engineer in the wiring and fittings department, to be chief motor assistant, at a salary of £160 per annum, rising by annual increments of £10 to £180. The Electric Lighting Committee has decided in favour of increasing the salary of Mr. S. E. Fedden, general manager to the electric supply department, from £800 to £900 per annum, in two annual increments of £50.

Obituary.—Mr. J. B. Alliott.—The death has occurred of Mr. Jas. Bingham Alliott, managing director of the well-known firm of Manlove, Alliott & Co., Ltd., engineers and refuse destructor manufacturers, of Nottingham.

CITY NOTES.

Canadian Westinghouse Co., Ltd.

The sixth annual report of this company states that for the year ended December 31st, 1909, there was a net profit of $198,380, an increase of 55 per cent. over the previous year. From the year's profits, quarterly dividends at the rate of 6 per cent. per annum have been paid, amounting to $261,540; $70,000 has been added to the general reserve for depreciation of plant and property, which account now totals $300,000. In addition to complete absorption as expense items, of all maintenance and replacement charges during the year, the sum of $62,460 has been written off items included in property and plant account which are not directly productive from a manufacturing standpoint, and $104,379 has been carried forward to the credit of profit and loss account, which shows the company's unapportioned surplus on December 31st, 1909, to be $536,104. In respect of the physical activities of the company, the year 1909 has been the reverse of its predecessor. While in 1908 the process was one of continuous and severe contraction of activity, in the year just ended a gradual and accumulative resumption has taken place to approximately normal conditions in quantity of output. The condition of keen competition in prices and deliveries, both foreign and domestic, has experienced no abatement; in fact, it has magnified during the year, making it a matter for very close attention in both the present and future conduct of the company's affairs. All departments—sales, engineering and manufacturing—have responded ably to the call made upon them by this situation, and the result accomplished by the total of net profits realised is a measure of successful effort. In the work of the past year the company has amply maintained its advanced position in the engineering and manufacturing fields. Many important engineering undertakings have been reduced to practical calculation and realisation in recent development of Canadian resources, and the company has had its usual large share in the resulting orders for electrical apparatus. Incidentally, the distinction rests with the company of having manufactured during the past year, the only transforming and switching apparatus yet produced in Canada for operation in connection with lines transmitting electrical energy at a pressure of 110,000 volts, the highest transmission voltage yet attempted in any part of the world; also, as an item in the year's manufacture, is included the largest generator yet built for a Canadian installation, and which embodies the highest refinement of electrical and mechanical structure. Sales during the year were the largest in the history of the company, about doubling those of 1908, and considerably greater than in 1906 (the company's previously largest year), when much higher prices for apparatus were obtained. The cost of manufacture has appreciably reduced during the year, and is an evidence of the continued efficiency of the plant and its manufacturing organisation. The company has during the year acquired office and warehouse premises in the city of Winnipeg. A suitable site on Portage Avenue East, one block from the principal commercial centre, was secured, and a building erected adequate for present needs and of sufficient capacity to take care for some years of the constantly increasing business of the North-West, for which Winnipeg is the main distributing point.

Calcutta Tramways, Co., Ltd.—The directors report that the receipts for the year to December 31st were £174,430, and the working expenses £107,677, leaving £66,752, plus £333 brought forward. Interest on debenture stock and bank advances and dividend on preference and ordinary shares paid, absorbed £42,449, leaving £24,636. Out of this it is proposed to pay a final dividend of 2s. 6d. per share, making 4½ per cent. for the year (£17,201), adding to the depreciation fund £7,000, and carrying forward £435. After adding to the depreciation fund £2,191 interest on investments, and £7,000 as above, and deducting £3,205 written off the renewals, the fund will stand at £55,941. The traffic receipts exceeded those of 1908 by £8,879, due in great measure to the influence of the extensions, which have not only added directly to the volume of receipts, but have also helped to develop the receipts upon the old system. As regards expenditure, whilst there has been a net decrease on the Calcutta system of about 1½ per cent., the total working expenses show an increase of £877, due to the fact that there has been a full year's working costs for Howrah, as against less than six months for that system for 1908. The Howrah system, which in 1908 was a drag upon the Calcutta receipts, has during the year 1909 turned the corner, and become an auxiliary, and though the amount of net profit was small, the tendency of receipts in Howrah continues to be upward.

Indo-European Telegraph Co., Ltd.

In their report for the year ended December 31st, 1909, the directors state that the traffics show a steady increase and have been carried with gratifying accuracy and speed, to which the direct working between London and Karachi has contributed to a marked extent. The lines are maintained in the highest state of working efficiency, but it has nevertheless become evident that the constantly increasing traffics render imperative a permanent increase in the carrying capacity of the system, and the directors are taking active measures with that object. The chief difficulty with which the company has had to contend during the year has been the simultaneous lengthy interruption of both the cables across the North Sea in which the company has leased wires. The question of additional cross-Channel cable accommodation is also receiving the close attention of the directors. The company's revenue from message account and other sources as shown in the revenue account amounts to £145,604, as compared with £132,837 for 1908, showing an increase of £12,767. The expenses are, on commercial and general account, £49,387, and on maintenance account £28,909, making a total of £78,296, as against £75,734 for 1908, showing an increase of £2,562. The revenue account, therefore, shows a balance of £67,308, which is carried to profit and loss account, 1909, and after deduction of income-tax paid is reduced to £63,269. To this is added the balance brought forward of £7,209, making a total of £70,478. Deducting the interim dividend of £10,625 already paid, there remains a balance available for distribution of £59,853. The directors now propose to declare a dividend for the six months ending December 31st, 1909, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, and to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. They also propose to set aside £15,000 towards the cost of increasing the carrying capacity of the system, and to hand over a further sum of £5,000 to the trustees of the retirement trust fund, carrying forward £7,978 to the credit of 1910.

Brisbane City Electric Light Co., Ltd.

The directors' report for the half-year ended January 31st, 1910, which was submitted to the meeting held on March 14th, states that during the half-year the output has been 1,066,088 units, as against 976 786 for the corresponding period of 1908-9. Comparing the revenue from the sale of electricity for the same periods, the increase has been 20 per cent., while the revenue from all sources has increased 23 per cent. The results for the half-year's working have been such that, after placing £500 to the credit of the franchise purchase sinking fund account, £150 to the accident insurance account, and a substantial sum to the credit of renewal replacement, and contingencies account, there remains a credit balance of £4,456, which with the balance brought forward from last half-year, makes a sum of £5,860 to be disposed of. The directors recommend that a dividend be paid at the rate of 6 per cent. per annum on the preference shares, and at the rate of 8½ per cent. per annum on the fully paid ordinary shares, and at the rate of 8½ per cent. per annum on the contributing shares in proportion to the amount paid up thereon. They also recommended the payment of a bonus at the rate of 2 per cent. per annum on the fully paid ordinary shares, and at the rate of 2 per cent. per annum on the contributing shares, in proportion to the amount paid up thereon. The payment of the above-mentioned dividends and bonus, together with the dividend duty, absorbed £3,909, leaving £1,951 to be carried forward. During the half-year the machinery, plant and mains have given entire satisfaction, and the good work of the staff has again contributed to the excellent results achieved. Good progress has been made with the new waterside power house in William Street, and as the contract stipulates for its completion within the year, the directors have ordered another 700-kw. turbo-generator; this, together with the necessary complement of boilers, pumps, &c., will, it is hoped, be erected and ready for use early in 1911. The laying of mains in the City and Valley areas has progressed steadily.

Wycombe (Borough) Electric Light and Power Co., Ltd.

The directors report that during the year ended December 31st, 1909, further progress has been made, the connections having risen from 49,648 to 51,025, being an increase of 1,377 equivalent 8-c.p. lamps. The result of the year's trading, including a balance of £77 brought forward, shows a profit to the credit of net revenue account of £4,900, and after paying interest on debentures and outstanding accounts £3,017, there remains a balance of £1,883 available for distribution. The directors recommend the payment of a dividend at the rate of 2 per cent. for the year, which will absorb £800, and that £1,000 be placed to the reserve fund for renewal account, leaving a balance of £83 to be carried forward.

Units generated	1,080,565
Units sold—Public lamps	186,861
By contract	236,667
Private consumers by meter	494,697
Quantity used on works	102,083
Distribution loss	57,754
Total quantity accounted for	1,028,083
Quantity not accounted for	52,583
Number of public lamps	12 arcs, 365 Nernst
Total maximum supply demanded, kw.	495
Lamps connected, January 1st	49,648
Lamps connected, December 31st	51,025

Prospectus.—*The Rural Electricity Supply Co., Ltd.*—A prospectus of this company is in circulation, and the list of subscriptions for an issue of 9,500 participating non-cumulative preferred shares of £1 each, will close on or before Monday, April 25th. The nominal capital is £10,000, consisting of the foregoing preferred shares and 10,000 deferred shares of 1s. each. Subscribers have the right to subscribe for three deferred for each five preferred shares. After the preferred have received a dividend of 7 per cent., one-fourth of the surplus will be paid to the holders of the participating preferred shares, and the remaining three-fourths to the holders of the deferred.

The company has been formed to establish electric light and power undertakings in country towns and the larger villages in the rural districts of England, where the cost of gas is high and its quality inferior. The metallic-filament lamp has altered the position in such places greatly in favour of electricity. The company will operate without Parliamentary powers, substituting therefor arrangements with the various local authorities. Wherever practicable, overhead wires will be employed. It is stated that the cost of management and establishment charges will be low, as they will be spread over a number of undertakings. Several propositions to establish undertakings are said to have been placed before the directors, but the names of these are not divulged, as agreements with some of them are awaiting signature when the company goes to allotment. The company proposes to commence with undertakings in six places at a cost varying from £700 to £2,000, and averaging £1,500, each station to be capable of supplying 2,000 to 3,000 lamps. Calculating upon a minimum output of 24,000 units per station per annum, and estimating upon 8d. per unit from the consumer, the income is set down as £4,800. Reckoning the works costs at 2d. and rent, rates and management at 1·5d. per unit, there is a gross profit on paper of £2,700. After London office, general management expenses, and directors' fees, have been deducted, also 7 per cent. for depreciation, £1,470 remains as net profits for reserve and dividends. To pay the 7 per cent. preference will need £665, so that there would remain for further division and reserve £805, plus any profits from electrical contracting work.

The directors of the concern include Mr. E. C. Jones, stockbroker, Mr. B. P. Gibbons (managing director), the chairman of the Burford and Lecblade Electric Light and Power Companies, Mr. G. B. Crockatt (also a director of the Burford Co.), Mr. Haydn T. Harrison, M.I.E.E., and Mr. T. E. Slaughter, electrical engineer. The consulting engineer is Mr. S. I. Pettitt, and the offices are at 11, Victoria Street, S.W., with Mr. H. Dixon as secretary.

The aspirations of the company are very worthy ones, and we wish it success, but the investor would of course like to know something about the six places, whether they are all certainties, or what will be the effect upon the estimates if some of them do not mature, what the terms and tenure under the unsigned agreements with the local authorities are, and whether the 7 per cent. for depreciation and the margin for reserves will be sufficient for providing against contingencies arising where security of tenure may be a doubtful factor.

Brisbane Electric Tramways Investment Co., Ltd.—For 1909 the revenue account, including £1,670 brought forward, shows an available balance of £69,757. Debenture stock interest absorbs £19,110; preference dividend, £17,695; interim dividend of 3s. 6d. per share on the ordinary shares, £13,125. Out of the remaining £19,826 the directors recommend that £1,000 be set aside to the accidents insurance fund, bringing it up to £3,000, that a balance dividend of 4s. 6d. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 8 per cent.), and that £1,951 be carried forward.

Merthyr Electric Traction and Lighting Co., Ltd.—The report for 1909 states that the gross receipts on the light railways amounted to £11,063, and the gross receipts on account of electrical supply to £6,911. After deducting all expenses chargeable to revenue, including debenture interest, and placing £1,500 to the renewals account, there remained a surplus of £4,007, making, with £490 brought forward, £4,498. There is to be placed to depreciation and reserve account £1,000, and a dividend of 5 per cent. on the ordinary shares is to be paid, leaving £498 to carry forward. There is to be put to the renewal and the depreciation and reserve accounts £2,500. The company has obtained the contract for the public lighting of the whole of Dowlais.

Rio Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. In view of the continuous growth and extension of the business and the increased earnings, the next quarterly dividend is to be payable on August 1st, at the rate of 1¼ per cent., thus placing the capital stock on the basis of 5 per cent. per annum.

Direct United States Cable Co., Ltd.—An interim dividend of 4s. per share, free of income-tax, being at the rate of 4 per cent. per annum for the quarter ending March 31st, 1910, is payable on and after the 25th inst.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the months to March 31st.

Rhondda Tramways Construction, Ltd.

Mr. L. V. Schlesinger presided on Friday of last week over the second annual meeting of this company, held at Winchester House.

In proposing the adoption of the report (see Electrical Review, page 560), the Chairman said the only item in the balance-sheet which called for comment, was that of sundry debtors, which stood at £8,714, which represented the balance of profit due from the tramway company. Sundry creditors stood at £2,174, which was made up of £2,133 money expended by the tramway company on the lines, the amount of which would be adjusted when the capital account of the tramway company was settled. The profit on operating the tramways for the year amounted to £16,000. The board had placed £3,500 to the reserve and renewal fund, although, as a matter of fact, it was only necessary to provide for depreciation, seeing that the District Council were bound to acquire the undertaking on the expiration of the lease. As to the cost of working the line, with the exception of Stockport and Belfast, their cost per unit was the lowest, being ·91d. The receipts this year, so far, had been satisfactory, being £1,653 in excess of the corresponding period of last year, even making allowance for the Easter holidays.

The report was adopted.

Indian Electric Supply and Traction Co., Ltd.

The directors' report for the year ended December 31st, 1909, states that the year's working in Cawnpore produced a surplus of £1,743, compared with a deficit of £9 in the preceding year. London expenditure amounted to £796 and interest to £1,703, leaving a deficiency of £756 for the year. With the balance of £17,231 brought forward from the previous year, the total amount at the debit of profit and loss account is £17,987. The progress report clearly indicates decided improvement in the company's business, this being more particularly marked during the last six months of the year. In last year's report the directors referred to the necessity of raising funds to pay off the creditors, and, at the same time, of reorganising the capital of the company; but owing to the improved results obtained, they proposed to defer any reconstruction for the present, and to provide for payment of the creditors and for the capital requirements of the business by an issue of £50,000 of 6 per cent. debenture stock, repayable at the end of 1912, by which time the earning power will be more clearly shown. Full particulars of the proposed issue were given in papers accompanying this report.

The annual meeting was held at Winchester House on Tuesday.

Mr. J. G. B. Stone presided, and in moving the adoption of the above report, said that, in order to bring the position of the company before the shareholders in as clear and concise a manner as possible, the board had issued a statement giving the progress of the business up to December 31st, 1909. From that they would see that the loss which previously resulted from the working of the tramway had now been eliminated, and that, generally speaking, the results from this, the least satisfactory portion of their business, were gradually improving. This year, up to March 12th, upon a slightly reduced mileage, they had carried 58 per cent. more passengers and increased the takings by 7½ per cent. With regard to the other side of the business, viz., that of supply for lighting and power for fans and for other purposes, the connections to the mains, which were equivalent to 10,665 8-c.p. lamps on December 31st, 1908, rose to 15,553 lamps by the end of 1909, and to 16,188 lamps at the end of February last. The numbers of units delivered to consumers other than the tramway during the five half-years the company had been in operation had been respectively 23,818, 48,469, 83,228, 94,274, and 167,366. The revenue returns for January showed, after allowing for the reduction in the agents' remuneration and for the continued suspension of the municipal track rent, a surplus on the month's working of Rs.4,000/5/7, the largest yet earned. This was at the rate of £3,200 per annum, an improvement of £740 upon the estimate based upon the results of the six months ended on December 31st last, which was given in the circular issued with the report. This figure confirmed the anticipation of continued progress. They were aware that ever since the company commenced operations, the United Provinces, of which Cawnpore was the commercial capital, had suffered very severely from dearth, amounting almost to famine, and pestilences, which latter had in all probability been aggravated by the insufficient nutriment imposed by high prices of food. This state of affairs seemed now happily nearly at an end. The food crops throughout the North-West had this season been exceptionally heavy. Oilseeds and cotton had also yielded bumper crops, which were being realised at high prices. These conditions had a direct and most important bearing on the spending power of the native population. In addition they would bring more work for the mills, and generally an impetus to business in Cawnpore. These factors should contribute very materially to the growth of their sales of current for various purposes. While there had been no profits available for dividend amongst the shareholders, the interest on the proposed debenture issue seemed assured, and ultimately the earnings were likely to increase sufficiently to give some return to the shareholders. In connection with the proposed issue of debentures, the negotiations had been prolonged, but he believed the board had made the best possible arrangements, and they urged the shareholders to subscribe for the issue, and so preserve their property.

Mr. K. A. Scott-Moncrieff, in seconding the motion, said that at the last meeting he told them he was by no means hopeless as to the position of the company, but he did not then think they would have such satisfactory figures to put before the shareholders as were contained in the report. The figures showed that while there had been a marked improvement in the extension of the business, there had been a reduction in the expenditure. The increased business had been obtained, in spite of the fact that during the whole of the year they had been battling against adverse circumstances. They had had practically no capital to spend in order to meet the requirements of the business. It should be borne in mind that in regard to the supply side of the company they had hardly touched the business in Cawnpore, for in that city of some 200,000 inhabitants they only had 122 private consumers, half of whom were European. They also hoped to extend among the native quarter by starting a wiring department. They could not do this, however, until they had got additional capital. He firmly believed that the debenture issue was a good investment from the shareholders' point of view, and that the new money was well secured, both as to capital and as to interest. The tramway, which was of course the worst feature of their business, was no longer taking money out of the company, but was making steady, although slow, improvement. The supply business would pay the interest on the new capital, and he had a lively hope that when they had more money they would be able to go ahead and earn some return upon the original expenditure.

Mr. E. P. S. Reed said he hoped the shareholders would respond to the appeal of the board and subscribe the debentures which they proposed to issue. There must be a very natural sense of disappointment in the mind of everybody connected with the company at the slow progress which had been made. Cawnpore had been very slow to avail itself of the facilities offered, but it would seem that the company had weathered five years of extreme leanness, and there now seemed every prospect of good business before them. A wise expenditure of money now would, he believed, help to retrieve much of the capital already spent.

The report was adopted.

Bromley (Kent) Electric Light and Power Co., Ltd.

The directors' report to December 31st, 1909, states that the lamp connections have increased from 84,052 to 89,282. It is satisfactory to note that in spite of the introduction of metallic-filament lamps, the sale of current shows a slight increase. The works have been maintained in good order and repair. The result of the year's trading, including £297 brought forward from last year, shows a profit of £12,196, and after payment of debenture interest and trustees' fees, amounting to £3,202, there is a balance of £8,994. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 7 per cent. per annum, making a total dividend of 5½ per cent. for the year, and that £2,096 be placed to reserve account for renewal of plant, and £2,600 to the general reserve fund, leaving a balance of £172 to be carried forward.

North Metropolitan Electric Power Supply Co.

The directors' report for the year ended December 31st, 1909, states that the revenue amounted to £88,925, an increase of £14,051 over 1908, and the expenditure was £44,504, being £1,291 only in excess of the previous year. The balance at the credit of the account is £44,421, which compares with £31,661 in 1908. This balance of £44,421, together with interest receivable and the amount brought forward from last account, makes a total of £47,040. After providing for debenture, loan and mortgage interest, and transferring £2,000 to the reserve fund for the redemption of debentures in accordance with the trust deed, there remains an available balance of £34,315, which the directors recommend should be applied as follows:—Placed to depreciation account £7,000, written off preliminary expenses and special items £3,500, dividend on the 6 per cent. cumulative preference stock, paid to October 31st and accrued to December 31st, 1909, £1,977, dividend on the ordinary shares at the rate of 6 per cent. per annum £21,001, carrying forward £837. The capital expenditure during the year was £40,263, and has now reached a total of £535,968. In accordance with the powers contained in the North Metropolitan Electric Power Supply Act, 1909 (hereinafter referred to), £75,000 6 per cent. cumulative preference stock has up to December 31st last been issued and is fully paid. The total number of units sold during the year was 16,402,447, which, compared with the previous year's figure of 14,069,611, is an increase of 2,332,836 units, or 16·5 per cent. The Willesden U.D.C. have decided to continue to take from the company a supply of energy in bulk for a further period of seven years upon the expiration of the present agreement in February, 1911. The business of the North Metropolitan Electrical Power Distribution Co., Ltd., at Barnet, Enfield, Hertford and St. Albans, continues to expand satisfactorily, the total connections to the mains at December 31st last being equivalent to approximately 61,450 30-watt lamps, compared with 45,200 lamps at December 31st, 1908. The North Metropolitan Electric Power Supply Act, 1909, which received the Royal Assent on May 25th, 1909, authorised, *inter alia*, the increase of the capital of the company from £500,000 to £750,000 by the issue of preference or ordinary shares or stock, as the shareholders may determine, and further borrowing powers up to one-third of the additional capital. Messrs. E. Garcke and W. L. Madgen offer themselves for re-election as directors.

Cork Electric Tramways and Lighting Co., Ltd.

The directors report that for the year 1909 the receipts were £51,363, and the expenses £31,685, leaving £20,178, plus balance brought forward £716, and less interest on debentures £4,600, leaving £16,294. Of this amount, £6,163 has been required for dividends on the 5 per cent. cumulative preference shares, £3,500 added to reserve for depreciation, £2,666 has been written off, as per revenue account, and the directors now recommend a 3 per cent. dividend on the ordinary shares, requiring £3,450, carrying forward £514. The lighting and power business shows satisfactory progress. During the year applications were received from new consumers for the equivalent of 9,430 8-c.p. lamps, of which 7,280 were connected up at December 31st. Owing to the extended use of metallic-filament lamps, the revenue from these sources is only slightly in excess of that for the year 1908, but benefit is now being derived from the new connections, and it is anticipated that the revenue for the current year will show a substantial increase. The Electric Lighting Order for the Cork Rural Districts has been transferred to this company, at a cost of £480. Contracts have been entered into with the District Council for the public lighting of the Douglas and Blackrock districts, and the supply for the Douglas district will be commenced shortly. The traffic revenue for the year shows a decrease of £600 as compared with the previous year. This is entirely due to the strike of the employés in May last, which necessitated the entire suspension of the tram service for 16 days, resulting in a loss of about £1,200 in traffic receipts. The receipts for the rest of the year were very satisfactory, and the above loss was partly regained. There is a reduction of £1,666 in the expenses and bad debts as compared with 1908. The capital expenditure during the year has been mainly expended on the District Lighting Order, additional plant in power station, house services and cables. No shares or debentures have been issued during the year.

	Traction.					Lighting and power.		
	Miles open.	Passengers carried.	Aver. fare.	Car-mileage.	No. of cars.	No. of customers.	8 c.p. (equiv.). Applied for.	Connected.
1907 ..	9·89	5,780,625	1·00d.	895,914	85	1,860	14,519	112,495
1908 ..	9·89	5,737,478	1·00d.	896,945	85	1,987	125,516	121,906
1909 ..	9 89	5,349,041	1·05d.	864,228	85	2,013	134,946	129,186

Metropolitan Electric Tramways, Ltd.

The directors' report for the year ended December 31st, 1909, shows a total revenue, including dividends from associated companies, of £363,613. The traffic receipts were £326,441, showing an increase of £26,428 over the previous year. After deducting all expenses chargeable to revenue, including £18,315 for reconstruction and renewals, and writing down preliminary expenses and other items by £3,091, there remains a surplus of £50,437, making, with the £3,707, the balance brought forward from the last account, a total of £54,145, which the directors recommend should be appropriated as follows:—To be placed to reserve account, £6,000; to the dividend on the preference shares for the year (already paid), £25,000; to the payment of a dividend on the ordinary shares at the rate of 5 per cent. per annum, £19,567; to be carried forward, £3,578.

At December 31st, 1909, the share and debenture capital of the company was:—£500,000 in 5 per cent. cum. preference shares of £1 each, fully paid; £891,337 in ordinary shares of £1 each, fully paid; £3 4,016 in deferred shares of £1 each, fully paid; £589,183 in 4½ per cent. first debenture stock; £200,000 in second debenture stock.

The £200,000 second debenture stock issued in December, 1908, as security for temporary loans, has, since the close of the year, been surrendered, and an issue of £250,000 5 per cent. debenture stock has been made, the proceeds of which will be applied to the discharge of the temporary loans mentioned above, the purchase of further rolling-stock, and the equipment of the remaining light railways to be leased from the County Council of Middlesex. £6,417 4½ per cent. first debenture stock was bought and cancelled last year under the operation of the sinking fund, reducing the amount outstanding at December 31st to £589,183. The stock was purchased at a discount, and the profit has been carried direct to the balance-sheet in reduction of preliminary expenses. The company have purchased the £22,161 Consols borrowed in 1903 from the British Electric Traction Co., Ltd., and deposited with the Middlesex County Council as security for the due performance of the company's obligations under the agreement of November 16th, 1900. These Consols, with the dividends accrued thereon, now form part of the reconstruction and renewals reserve, invested in the joint names of the Middlesex County Council and the company. Four additional sections of light railway in the county of Middlesex were opened for public traffic during the past year, bringing the total length of the system operated by the company at December 31st last to 5½ miles. The remaining 4½ miles of the authorised light railways of the Middlesex County Council are in course of construction, and will probably be completed before the end of the present year. The purchase of the portion of the Harrow Road tramway in the county of London by the London County Council was completed on October 18th last. Since that date the company have continued to work the line under the terms of the agreement with the Council referred to in the last report. The extension of the tramway to Edgware Road is now being constructed, and will, it is anticipated, be opened for traffic in the course of the summer.

The company's holding in the North Metropolitan Electric Power Supply Co. consists of 40,000 ordinary shares of £10 each, of which 30,000 are fully paid, and the balance £5 per share paid. The revenue of the Power Supply Co. shows a satisfactory expansion, the number of units sold during the past year exceeding 16,000,000. The dividend receivable for 1909 amounts to £21,000, being at the rate of 6 per cent., as against 5 per cent. for the preceding year.

In addition to supplying electrical energy for the tramways and light railways, the Power Supply Co. are working the electric lighting orders of the Tottenham and Edmonton Councils, and are selling electricity in bulk to the Borough Council of Stoke Newington, the Urban District Council of Willesden, and the Hendon Electric Supply Co., Ltd., for the purposes of their respective lighting orders, and to the North Metropolitan Electrical Power Distribution Co., Ltd., for their electric light undertakings in the towns of Enfield, Barnet, Hertford and St. Albans. Electricity is also being supplied direct to an increasing number of power users.

The North Metropolitan Electric Supply Act, 1909, extending the area in which the Power Supply Co. may supply for power and lighting purposes, and authorising an increase of capital, received the Royal Assent on May 25th, 1909.

Mr. E. Garcke and Sir Ernest Spencer offer themselves for re-election as directors.

	December 31st, 1908.	December 31st, 1909.
Miles open	42·375	51·50
Number of passengers carried ..	57,639 307	62,337,947
,, car-miles run.. ..	6,361,253	7,033,186
Average receipts per car-mile ..	11·32d.	11·12d.
,, ,, per passenger ..	1·25d.	1·25d.
Number of cars in stock	212	287

In the accounts accompanying the above report there are some unsatisfactory points, the consideration of which leads us to an adverse conclusion. Let us, however, indicate a few of the more salient features which they present. The amounts written off are meagre, and £1,528 in respect of salaries is transferred from the debit of profit and loss account to that of capital, a proceeding which seems peculiar to the B.E.T.; £1,900 is charged for directors' fees, after taking credit for directors' fees from associated companies. This figure seems absurd; most of the directors are on the boards of other B.E.T. flotations. Turning to the balance-sheet, but scant detail introduces that portion of the assets and capital expenditure amounting to £1,881,913, a descriptive account of the composition of which would be interesting. What has become of the sum exceeding £700,000 less a minor credit for shares acquired in the North Metropolitan Tramways Co., which is now practically *non est*? Similarly, what has become of the £30,000, or thereabouts, for shares, &c., in the Harrow Road and Paddington Tramways Co.; the £200,000, less small credits for materials, &c, paid to the North Metropolitan Tramways Co. for tramways purchased in Middlesex, which were subsequently electrified?—*vide* previous balance-sheets. There is no necessity for further particularisation. If they are included in the sum of £1,881,913 above mentioned—they do not appear to have been written off—that sum, to the extent indicated, is not represented by existing assets, but by mere water. If that be so, we should have thought that there was ample room for a liberal application of the writing-down process to such expenditure; but such a sound course, though not pleasant to the shareholders in the undertaking, would be equally, if not more so, unpleasant to the shareholders in the B.E.T., which company has had a large amount of paper of the concern, nor possibly would it be quite convenient in the event of the local authorities exercising their powers of purchase at the proper time. £64,000 is still included in the balance-sheet in respect of commissions and discounts on share and debenture issues, which, of course, does not represent any asset at all. And yet we have a reserve. Since the date of the accounts the Metropolitan Electric Tramways have offered to the public £250,000 of 5 per cent. debenture stock at £91 per cent. At 91? The discount amounts to £22,500, and the underwriting commission and printing of the prospectus, &c., to £11,250, making a total of £33,750, which sum—probably less the cost of issuing the prospectus will go to swell the £64,000 indicated. No wonder we read "there was not much demand for Metropolitan Tramways second debenture issue." The report states that some £6,417 of the 4½ debenture stock has been bought and cancelled, the stock having been purchased at a discount, and thereby at a profit. We do not wonder that the stock was bought at a discount. There is a contingent liability in respect of the company's guarantee for the payment of £52,848 outstanding on a mortgage upon the power station purchased by the North Metropolitan Electric Power Supply Co. from the Willesden Urban District Council. Turning to the previous published balance-sheets of the company, it will be remembered that in order to obtain a preponderating or controlling interest in the North Metropolitan Tramway Co., the Metropolitan Tramways, Ltd., acquired, out of a total of 110,000 shares issued by the former company, 78,504 of such shares in exchange for 314,016 5 per cent. preference, and 314,016 deferred shares of £1 each in the Metropolitan Co., the B.E.T. receiving 78,504 ordinary shares in the Metropolitan Tramways, Ltd., for their remuneration in the deal. No dividend has been paid on the deferred shares, and one does not seem likely. The B.E.T. have, or had, a very large holding in the Metropolitan Tramways, and we are not envious. What is obviously required is a reduction to vanishing point of all expenditure that is not represented by assets due in part at any rate to the financial expenses that the company has incurred in the past.

Italy.—The balance-sheet of the A.E.G. Thomson-Houston Societa Italiana d'Elettricita, of Milan, for the last financial year shows a net profit of £23,062, as compared with £29,370 the preceding 12 months. The dividend is being maintained at 6 per cnet.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

New York Central and Hudson River Railroad Co.—$14,688,800 additional capital stock; and $5,000,000 additional 30-year 4 per cent. gold debentures, 1934, Nos. 48,001 to 48,000, for $1,000 each.

Veritys, Ltd.—£60,000 5 per cent. mortgage debenture stock.

Western Union Telegraph Co.—$20,000,000 4½ per cent. funding and real estate mortgage 50-year gold bonds, due 1960, Nos. 1 to 20,000, for $1,000 each.

MARKET QUOTATIONS.

Wednesday, April 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a ,, ,, ...	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£10	..
a Copper Sulphate	,,	£19	..
a Lead, Nitrate	,,	£26	..
a ,, White Sugar	,,	£23 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¾d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3¾d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %) ..	,,	£11	..
a ,, Chlorate	per lb.	8¾d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	£5 inc.
b ,, Wire, in ton lots ..	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	..
c ,, Tube (brazed)	,,	9d.	..
c ,, ,, (solid drawn) ..	,,	7½d.	..
c ,, Wire, basis	,,	6⅝d.	..
c Copper Tubes (brazed)	,,	9d.	..
c ,, ,, (solid drawn ..	,,	8¼d.	..
g ,, Bars (best selected) ..	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars ..	,,	£61	£1 dec.
e ,, ,, Sheets ..	,,	£77 5	£1 dec.
e ,, ,, Rod ..	,,	£65 15	£1 dec.
e ,, ,, H.C. Wire	per lb.	7½d.	¼d. dec.
f Ebonite Rod	,,	6/-	2/9 inc.
f ,, Sheet	,,	5,6	2/6 inc.
n German Silver Wire	,,	1/6	..
h Gutta-percha, fine..	,,	0,6 to 11/-	..
h India-rubber, Para fine	,,	12/8	1/1 inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/10½	2½d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£18	7/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large ..	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/3	..
p ,, ,, rolled strip & sheet	,,	1/8	..
o Platinum	per oz.	120/-	variable.
c Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£147 to £148	£2 dec.
n ,, Wire, Nos. 1 to 16	per lb.	1/10	½d. inc.
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£26 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Babcock & Wilcox, Ltd.—The directors have declared a dividend of 3s. 2½d. per share, free of tax, on the ordinary shares, making, with interim dividend, a total distribution of 24 per cent. for the year to December 31st, compared with 20 per cent. for 1908.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—A dividend is declared at the rate of 6 per cent. per annum on the preference shares for the six months ended March 31st.

Primitiva Gas and Electric Lighting Co. of Buenos Ayres, Ltd.—At the annual meeting called for April 22nd, resolutions will be submitted altering a number of the articles and changing the name of the company to Primitiva Gas Co. of Buenos Ayres, Ltd.

STOCKS AND SHARES.

Tuesday Evening.

THE expansion of Stock Exchange business received something of a check as apprehension quickened of a possible rise in the Bank Rate. Rubber shares, moreover, experienced a quiet shake-out at the end of last week, and although a good part of the loss was recovered, the public's appetite for rubber shares has been less keen than it was when last we wrote.

Owing to the immense public interest taken in rubber shares, a good deal of selling has taken place in other markets, so that the cash may be available for the popular speculation. It is the common thing for the broker to be told, as he goes from one market in the Stock Exchange to another, "we have been killed by rubber." In spite of this, however, and of the financial fears just mentioned, there is a fair amount of business all round the Stock Exchange.

With rubber making fresh high records every day in Mincing Lane, it is but natural that the shares in the producing and dividend-paying companies should maintain their prices with much firmness. While the weeding-out process was being applied to speculators in what have come to be known as "Penny Bazaar" shares, the older-established concerns were little affected by the selling, and so long as the raw material keeps up in value, so long, of course, will the quotations continue good for the best class shares.

It is rather disappointing that the railway boom shows so little sign of continuing good. Certainly the Bank Rate fears are a weight upon the market, but besides this the general interest appears to be evaporating, and prices tend to slide. The electrical section has not much to complain about, except as regards paucity of business, for City and South London has risen 1½, and Districts are a small fraction to the good. The opening of the Anglo-Japanese Exhibition next month is declared to have been discounted as a reason for advancing the prices of Central London stocks, but, of course, it remains to be seen how the attendance will work out. Bumper traffics, it goes without saying, could not fail to have a stimulating influence upon the prices of Central Londons and Metropolitan Consolidated.

In the telegraph list, Great Northerns and Indo-Europeans are conspicuously strong, the latter upon the issue of an excellent report. A further recovery in Marconi shares carried the price to 1⅛. Eastern Extensions are a trifle easier, and the Anglo-American varieties suffered by reason of a general weakness in the American market, which was not thrown off until last Monday night. American telephone and telegraph stock has regained part of its dividend. Orientals parted with their ⅓ gain of last week, and United River Plate Telephone shares are duller.

The weakness of Americans did not prevent a strong tone in the Mackay Companies' issues, and the Common gained a point, while the Preferred added 3. Globe Preference went a little weaker on the pressure of a few shares for sale.

Electricity Supply shares are a deadly dull market. Brompton Ordinary eased off, and London Electric Preference similarly reacted. St. James' and Pall Mall Ordinary rose ⅛; Chelseas are also ⅛ better.

Even the Canadian-Mexican group is uninteresting, the same remark covering the tramway-traction descriptions. Canadian General Common and Preference moved in opposite directions on the issue of a good report.

Metropolitan Electric Tramways Ordinary shares are a better market at 14s. 4½d., and London United Preference keep steady at 3. British Electric Traction rose ⅛. Underground Electric Income bonds went back after their recent sharp rise. The British Columbia Electric Railway issues have weakened; Calcutta Trams are 2s. 6d. up.

Steadiness characterises the market for manufacturing shares. Babcock & Wilcox have further advanced on the dividend and bonus. Castner-Kellners gained 1/16. Further descriptions are hard, without much quotable change.

Swiss Aluminium Dividend.—The lower of the two estimates recently reported in connection with the financial results of the Aluminium Industry Co., of Neuhausen, for 1909, has proved to be correct, inasmuch as the directors, at a board meeting held on Friday at Frankfort, resolved to recommend the payment of 12 per cent. for the year, as compared with 18 per cent. for 1908. There remains a balance of £38,000 to be carried forward, as against £42,000 in the preceding year. It is added that the works were fully employed during the year, the orders on hand are favourable, and the price of the metal shows an improvement as contrasted with last year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations April 5th.	Closing Quotations April 12th.	Business done week ended April 12th. 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	Nil.
116 200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$235,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	137 —139 xd	139 —141 xd	..	..	+ 2	5 13 6
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	94½	..	4 4 8
558,460	Anglo-American Telegraph	Stock	3¾%	3¾%	£3 4s.	3⅜%	59½ — 61½	59 — 61	60	59	— ½	5 18 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102½ —103½	102½ —103½	103⅛	102	..	5 16 3
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	18⅜ — 19½	18½ — 18⅝	18⅜	..	— ⅛	6 13 4
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ —101½	99½ —101½	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 1/16 — 8 3/16	8 1/16 — 8 3/16	8¼	..	..	4 16 3
2,449,176	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89 xd	87 — 89 xd	88⅜	88½	..	4 9 11
16,000	Cuba Telegraph	10	5 %	6 %	6 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3¼ — 3⅜	3½ — 3⅝ xd	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8½ xd	7⅞ — 8½ xd	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
60,710	Direct United States Cable	20	4⅜%	4⅜%	4⅜%	..	13⅞ — 14⅜	13½ — 14	13½	..	— ⅜	6 1 5
39,520	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 —140	137 —140	138½	..	..	5 0 0
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	86 — 88	86 — 88	88	87½	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 — 105	103 —105	104½	..	..	b 16 2
900,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12⅞ — 13⅛	12⅞ — 13⅛	13⅛	12⅞	— ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	102¼	101	..	3 17 8
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —103	101 —103	..	..	+ ⅛	3 17 8
181,127	Globe Telegraph and Trust	10	5½%	5⅞%	5⅝%	..	10½ — 11	10½ — 11	10⅞	10⅜	..	5 4 7
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½ — 13¾	13⅜ — 13⅝	..	..	— ⅛	4 8 1
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	20 %	18 %	..	29 — 31	31 — 32	31⅛	..	+1	5 12 6
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102 *	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	54 — 56	54½ — 56½	55	54¾	+ ⅛	5 14 0
$41,880,400	Mackay Companies Common	$100	3¾%	4 %	4 %	4⅛%	91 — 93	91 — 93	..	..	..	4 11 5
$60,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 80	80 — 84	..	..	..	4 15 8
924,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	2/- — 2/3	2/- — 2/3	15/6	..	+5/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	¾ — 1	¾ — 1	19/9	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	2/- — 2/3	2/- — 2/3	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	105	104	— ½	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½ —125½	123½ —125½	124⅞	124	..	4 15 7
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10¼ — 10⅝	10⅛ — 10⅜	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	98 —100	98 —100	100	..	..	5 10 0
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1⅜ — 1½	1 3/16 — 1 5/16	29/4½	26/10½	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	23/9	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	8	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	101⅛	..	..	4 8 8
3,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	..	131 —134	131 —134	131	..	..	4 9 7
120,000	United River Plate Telephone	6	8 %	8 %	8 %	..	7⅞ — 7 7/8	7⅞ — 7⅞	7⅞	7⅞	— ⅛	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅜	..	..	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14¼ xd	13⅜ — 14¼	13 1/16	..	..	4 18 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/32 — 3/16	3/32 — 3/16	16/-	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8⅝ — 9¼	8⅝ — 9¼	9⅛	..	..	6 9 9
4,569	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	12 6	..	8¼ — 9¼	8¼ — 9¼	..	..	..	6 9 9
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½ —102½	100½ —102½	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4 1/16 — 4 1/8	4 1/16 — 4 1/8	95/-	92/6	..	5 1 8
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	5	..	..	..	5 %	4⅛ — 4⅜	4 7/16 — 4½	92/6	90/7½	— 1/16	5 6 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90 — 91½	90 — 91½	91½	90½	..	4 7 5
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	105 —107	105¾	104½	+1	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	24 %	5 3/16 — 5 5/16	5⅛ — 5⅜	5 5/16	5	+ ⅛	4 9 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98	95 — 98	..	..	..	..
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	145 —149	144 —148	148	145	—1	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	121 —125	123	120½	—1	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110½ —112½	109½ —111½	111½	110½	—1	4 9 8
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	24/4½	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	8 %	1¼%	..	3 — 3⅛	3⅛ — 3⅜	72/6	67/6	+ ½	4 0 0
1,178,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	91 — 94	90 — 98 xd	90½	89½	..	5 7 6
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 72	..	..	— ½	6 5 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7⅜ — 7⅞ xd	6⅝ — 7⅛ xd	7⅜	7⅛	— ¼	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6 — 6½	..	..	— ¼	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	90 — 94	90 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	3/32 — 1/16	3/32 — 1/16	..	..	..	Nil
1,916,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	47	..	..	7 16 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
900,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
195,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
195,000	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	4½%	4½%	4½ — 4⅝	4⅜ — 4⅞	96/3	87/6	+ ⅛	4 12 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	93 —101	99 —102	..	..	+1	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10 — 10¾	10 — 10¾	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅛ — 2⅜	2 1/16 — 2 1/8	53/3	51/3	+ 1/16	4 14 4
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,990 690	Central London Railway, Ord. Stock	Stock	4 %	8 %	8½%	8 %	70 — 72	70 — 72	..	..	..	4 8 4
564,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	86½	..	..	4 10 11
564,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	54	..	..	3 12 9
1,480,000	City and South London Railway	Stock	2½%	3½%	1¼%	1½%	33 — 34	34½ — 35½	35	34	+1½	4 18 7
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations April 5th.	Closing Quotations April 12th.	Business done week ended April 12th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	⅞ — 1	⅞ — 1	17/6	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1⅛ — 1½xd	1⅛ — 1⅜ xd	..	..	..	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	13 — 14	13 — 14	..	..	..	4 7 8
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	2½ %	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½ %	2½ %	Nil	..	1 — 1½	1 — 1½	..	..	..	5 14 4
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	6 1 11
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82 xd	79 — 82 xd	6/9	..	..	Nil
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	10 4 0
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1½ — 1⅝	1½ — 1⅝	..	..	..	6 1 3
35,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛ — 8¼	7⅛ — 8¼	..	..	..	4 18 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86 xd	82 — 86	17/6	..	..	Nil
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	6 10 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10⅜ — 10⅝	10½ — 10⅝	..	..	..	4 16 10
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 —103½	..	..	..	5 14 3
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12⅜ — 13⅜	12⅜ — 13⅜	12⅜	..	— ½	4 3 9
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5 — 5⅜ xd	5 — 5⅜ xd	..	..	..	4 3 9
160,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105½—107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	15⅝ — 16½	15⅝ — 16½	16⅛	15⅜	..	6 3 1
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	9 1 10
600,070	London United Trams. (1901), 1 to 50,007	10	5 %	5 %	Nil	..	1⅛ — 1¼	1⅛ — 1¼	..	..	..	Nil
899,980	Do. do. 50,008 to 100,000	10	5 %	5 %	Nil	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜ %	..	2⅛ — 2½	2⅛ — 2½	65/-	62/6	..	11 10 10
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	..	4 %	4 %	71 — 74	71 — 74	74	73	..	5 8 1
5,782,062	Metropolitan Consolidated	100	1 %	½ %	½ %	1 %	44⅜ — 45½	44½ — 45	45½	44⅜	— ½	2 15 7
2,640,914	Do. Surplus Lands	100	2½ %	2½ %	2½ %	2½ %	68 — 70	69 — 70	69	68½	..	3 18 7
3,385,000	Do. District	100	Nil	Nil	Nil	Nil	22⅛ — 23	23⅜ — 23⅝	23⅜	22⅞	+ ⅛	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	4½ %	..	⅞ — 1	⅞ — 1	1/3	..	..	5 16 2
814,016	Do. do. Defd.	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅝ — ¾	⅝ — ¾	15/6	15/-	..	6 8 1
595,800	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	96 — 99	96 — 98	96⅞	96⅜	..	4 10 11
$10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	133 —135	132 —134	133⅜	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	94⅜ — 95⅜	94⅜ — 95⅜	94⅝	94⅜	..	5 4 9
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ¼	⅛ — ¼	10/3	..	..	6 17 11
245,500	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	84 — 87	84 — 87	..	..	..	5 8 6
245,000	Telegraph Construction and Maintenance	12	15 %	17½ %	15 %	17½ %	84 — 85½	84 — 86½ xd	85⅛	84	..	5 16 0
37,850	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
140,000†	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	102½—103½	102½—103½	103⅜	102½	..	4 16 7
1,000,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	90⅜	89½	..	4 18 4
2,800,000	Do. do. 6% Income Bonds	..	..	..	..	..	40 — 42	38 — 40	40⅜	38½	—2	..
4,900,000	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1½ — 2½	1½ — 2½	..	..	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝	4½ — 4⅝	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10%	10	10 %	10 %	7½ — 8 xd	7⅝ — 7⅞	7⅞	..	— ⅛	6 10 1
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½ xd	7 — 7½	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½ xd	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 4⅝	4½ — 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8¼ — 4⅜	8¼ — 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	98½	..	..	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	8½ — 4	3⅞ — 4¼ xd	76/-0½	..	+ ⅛	4 15 6
175,000†	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —102	101 —103	102	..	+1	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	11½ — 12 xd	11⅜ — 12 xd	11⅜	11⅛	..	5 16 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13 xd	12 — 13 xd	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	102½	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅝ — 2	1⅝ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3⅛ xd	2⅜ — 3⅛ xd	..	..	..	7 18 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅞ — 8¼	7⅞ — 8¼	8	..	..	6 8 1
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛ xd	10⅛	..	..	5 7 10
400,000†	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	108 —106	108 —106	10⅜	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1⅝ — 1¾	1⅝ — 1¾	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	73 — 75	72 — 75	..	..	..	6 0 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	83 — 86	83 — 86	84½	84	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝ xd	4½ — 4⅝ xd	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ — 4½ xd	4⅜ — 5⅛ xd	..	..	..	4 15 3
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
15,000	Hove, 1 to 15,000	5	9 %	8¾%	8½%	8½%	7 — 7½ xd	7 — 7½ xd	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½—104½	102½—104½	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7½	7 — 7½	7	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5¼	97/6	..	— ⅛	5 14 3
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	87/6	82/6	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	92/6	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	104	..	..	4 4 1
946,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	84	..	..	4 1 5
$6,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ — 85½	84½ — 85½	85½	85	..	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	81½ — 83½	81 — 83	82⅝	82½	— ⅛	4 4 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103⅜ —105½	103½ —105½	104⅝	103⅜	..	6 12 8
19,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	100	..	..	5 %	5 %	90½ — 91½	90 — 91	90⅝	90	..	5 9 7
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96⅜ — 98⅜	96⅜ — 98⅜	..	..	..	4 11 5
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	4½ — 4⅝ xd	4½ — 4⅝ xd	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅝ — 4⅞ xd	4½ — 4½	..	..	— ⅛	5 5 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 — 101	99 —101	..	..	..	4 19 0
10,858	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ — 12⅜	11⅝ — 12⅝ xd	..	..	..	5 9 10
20,000	Oxford, 1 to 98 and 407 to 20,319	5	7 %	7 %	7 %	7 %	6⅛ — 6⅜ xd	6⅜ — 6⅝ xd	6⅜	..	..	5 8 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
119,694	River Plate Electy. Co. Ord. Nos. 1 to 120,507	1	2½%	6 %	8 %	..	1⅝ — 2	1⅝ — 2	38/3	38/-	..	4 0 0
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	4 16 0
200,000	Do. do. 6% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102½—104½	103 —105	104	..	+ ½	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8⅜ — 8¾ xd	8½ — 0	..	..	..	5 14 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6 — 6½ xd	6⅞ — 7⅛	..	..	..	5 7 8
150,000†	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2⅛	1⅝ — 2⅛	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅜ — 3	2⅜ — 3 xd	..	..	..	6 13 4
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	..	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅛ — ⅜	⅛ — ⅜	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	..	..	..	6 4 5
254,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101 xd	98 —101 xd	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	½ — 1 xd	½ — 1 xd	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1½ — 2 xd	1½ — 2 xd	..	..	..	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81 xd	79 — 81 xd	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	⅛ — ⅜	⅛ — ⅜	17/6	..	..	5 6 6
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅜ — 9	8½ — 9	⅝	..	..	5 11 1
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	5 — 5½	5⅛	9⅝	+ ⅛	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th, 1910.

PROCEEDINGS OF INSTITUTIONS.

Steam Turbine Driving in Textile Mills.

In a paper read before the Manchester Association of Engineers, in the early part of this year, dealing with the above subject, Mr. G. B Storie, of Rochdale, gives some interesting details regarding turbine applications at home and abroad.

He states that although turbine driving in mills is only 9 or 10 years old, there are to-day not less than 480 turbines in use for that purpose, aggregating 300,000 H.P. About 3 per cent. are for mechanical driving, the remainder being direct-coupled to generators—mostly alternating-current machines—for electrical driving; it is possible that the advantages of the induction motor for driving weaving and spinning machinery account for the preponderance of alternating plants.

Probably the largest turbine yet installed for textile mill work is one of 3,250 KW. by the Allis-Chalmers Co., at the Pacific Mills, Lawrence, Mass.

The following table gives some particulars of the turbines constructed up to a recent date by some of the principal makers for textile mill driving:—

TABLE I.

Name of firm.	No.	H.P.	Type.
The G.E. Co. of U.S.A. ...	40	67,400	Impulse
Brown, Boveri & Co.	57	50,580	Reaction
A.E.G.	44	46,000	Impulse
Allis-Chalmers Co.	24	38,466	Reaction
The American Westinghouse Co.	23	20,000	Reaction
The Zoelly Syndicate	16	14,070	Impulse
The Swedish De Laval Co. ...	118	10,687	Impulse
Greenwood & Batley, Ltd. ...	33	9,125	Impulse
The French De Laval Co. ...	80	8,000	Impulse
The British Westinghouse Co....	6	8,000	Reaction
The B.T.-H Co.	5	6,400	Impulse
Willans & Robinson, Ltd. ...	6	4,700	Reaction
Franco Tosi, Milan	3	3,400	Reaction
Gebruder Sulzer, Winterthur ...	1	2,500	Reaction
The Brush Elec. Eng. Co. ...	3	1,950	Reaction

The first turbine used for mill purposes in England was supplied by Greenwood & Batley, Ltd., of Leeds, in 1899, to the order of Messrs. Ormerod Bros., of Brighouse. It was of the De Laval type, and capable of developing 150 B.H.P. Since that date 33 turbines for the electrical, and 21 for the mechanical driving of textile mills have been installed, aggregating 24,500 and 5,500 H.P. respectively.

The principal turbine plants driving textile mills in England, with some leading particulars, are given in Table II.

TABLE II.

User.	Makers' name.	Type.	Load in KW.	Steam pres. lb. per sq. in.	Vacuum. in. of mercury.	Revs.	Voltage (A.C., 50 periods)	System of condensing
—	A.E.G.	Hor. Curtis	2 000	150	28½	1,500	500	Surface
—	,,	,,	1,000	170	28½	3,000	,,	,,
—	,,	,,	1,000	170	28½	3,000	,,	,,
—	,,	,,	1,000	170	28½	3,000	,,	,,
Kearsley Spinning Co.	,,	,,	750	200	28	3,000	550	Surface
	,,	,,	,,	,,	,,	,,	,,	,,
Ark Mill, Ltd.	Fraser Siemens	Rateau	600	160	28	3,000	500	Bar. jet
	,,	,,	,,	,,	,,	,,	,,	
Ashton, Harrison & Co.	Willans-Siemens	Willans-Parsons	1,000	200	27	1,500	,,	Surface
Thor Cotton Spinning Co.	,,	,,	500	160	28	3,000	,,	Surface
	,,	,,	,,	,,	,,	,,	,,	,,
Mellor & Sons	Greenwood and Batley	Multiple De Laval	1,000	200	—	1,500	,,	Bar. jet
Falcon Mill, Ltd.	Musgrave-Siemens	Zoelly	400	160	28	3,000	,,	Bar. jet
	,,	,,	,,	,,	,,	,,	,,	,,
Braidwater Spinning Co.	B.T.-H. Co.	Hor. Curtis	750	150	,,	,,	,,	Korting ejector
Ashworth, Hadwin & Co.	Willans-Dick, Kerr	Willans-Parsons	750	185	28	1,500	440	Surface
Sladen Wood Mill Co.	Brush	Brush-Parsons	500	200	28	3,000	500	Surface
—	,,	Brush-Parsons	535	160	28	3,000	,,	Surface

The author describes a Curtis turbine plant at Messrs. Greaves's Forth River Mills, Belfast, built by the A.E.G., and coupled to a 450-KW. 50-cycle 500-volt three-phase alternator (power factor 80 per cent.), which supplies motors for driving machines on the group system, as well as for the individual driving of ring-spinning frames. The turbine is of the mixed-pressure type, with nozzle regulation on each of the two stages.

Various numbers of nozzles are grouped on to separate steam inlet valves in the second stage, this arrangement permitting of fine steam adjustment, where steam is taken from the casing for heating purposes at a particular pressure, or steam introduced from other engines.

The turbine, which runs the whole week without a stop, is intended for two conditions of working. In the day-time the mill is heated by means of exhaust steam from a reciprocating engine, but as all the steam is not required for that purpose, part is utilised in the turbine for the generation of electric power. During the night when the engine is shut down, steam is obtained for heating purposes by extracting it from the turbine between the first and second stages at a pressure slightly above that of the atmosphere. Figs 1 and 2 show the steam consumption diagrams for the above conditions of working.

In the case of the Sladen Wood spinning mill, at Littleborough, a 500-KW. 3 000 R.P.M. Brush Parsons turbine plant is in use. For ventilating the alternator, air is drawn in through ducts in the bedplate, and in winter the heated discharge is conveyed to the mill for warming purposes. The condensing plant motors on full duty absorb 12 KW.

A De Laval turbine mechanical drive in a weaving factory consists of a 300-H.P. turbine running at 10,600 R.P.M.; this speed is

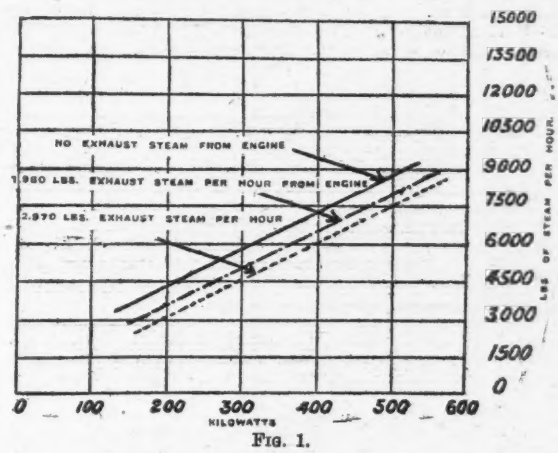


Fig. 1.

reduced by double helical reduction gear to 750 R.P.M., and power transmitted by two rope pulleys on the gear shafts, each having 24 ropes, driving the second motion shaft at 189 R.P.M.

The author considers that there is less risk of breakdown with the turbine than the reciprocating engine; the cost of repairs is smaller, and the time taken to carry them out much less. Accidents to blades in the nature of stripping might be avoided if the same care were exercised with the turbine as with reciprocating plant.

In the matter of breakdowns, one may compare the bursting of a low-pressure cylinder of an engine of 800 H.P., with the stripping of a set of blades in one of the expansions of a turbine of similar power. In the former case there would probably be a stoppage of three or four weeks, entailing a loss to both owner and workpeople, and the cost of replacing the cylinder would amount to about £140, whereas in the latter case, it would only be necessary to stop a sufficient length of time, say, six or eight hours, to remove any blades that might still remain in the damaged expansion, and clean out the cylinder. The turbine would then be in a condition to run until the week-end, when the reblading could be done; this repair would involve an expenditure of £18.

The speed regulation of turbines can be carried out in a more perfect manner than is possible with reciprocating engines. Too much importance cannot be attached to this, as the quantity and

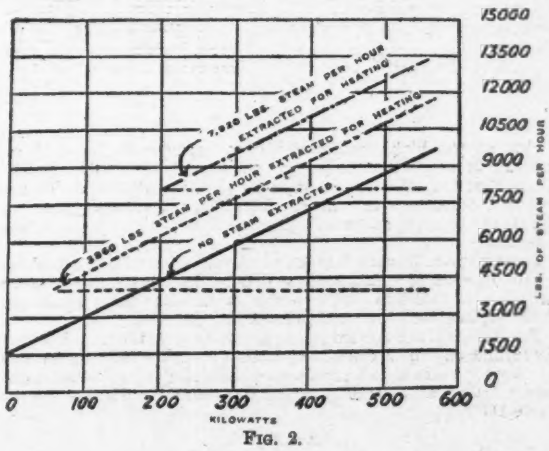


Fig. 2.

quality of the yarn and cloth produced in spinning and weaving factories depend upon uniformity of speed perhaps more than upon any other factor.

For purposes of comparison, the author has taken a number of records with Moul's tachograph to show the cyclical variation in the shafting at various points of the drive in mills driven both by mechanical and electrical power. The records are shown in fig. 3, and particulars of the driving arrangements in each case are given below:—

(a) Ring spinning mill with modern rope drive. Three-crank vertical inverted engine, 1,000 I.H.P., 82 revolutions, with rope fly-

wheel 16 ft. diameter, weighing 36 tons. The engine is controlled by a Whitehead governor acting directly on the Corliss valve gear of the high-pressure cylinder. Angle of cranks 120°, sequence H.P., L.P., I.M.P.

(*b*) Weaving shed. Rope drive to line shaft in shed, from which the cross shafts are driven in the usual manner through bevel gearing. De Laval turbine developing about 310 H.P. The rope pulleys on the turbine shaft run at 1,000 R.P.M., and the line shaft at 120. The speed reduction is accomplished in two steps.

(*c*) Ring spinning mill. Electric drive. 500-KW. turbo-alternator, 500 volts, three-phase, 50 periods. Line shafts driven by induction motors.

Experience has shown that it is not advisable, in the case of reaction turbines, to use steam at a higher temperature than about 560° F., on account of the effect of excessively high temperatures on the materials of construction. The author has seen unsupported

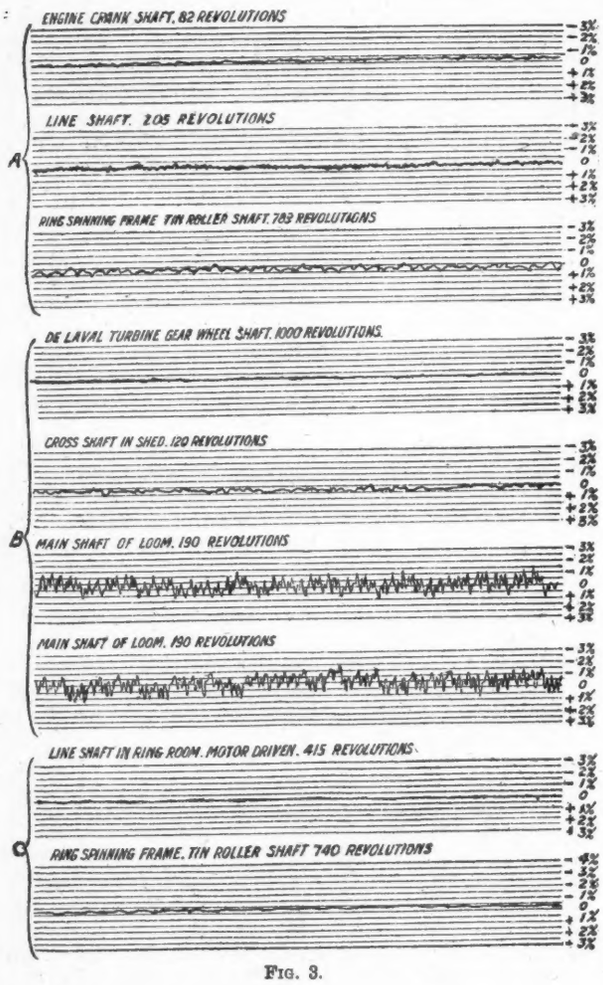

ENGINE CRANK SHAFT. 82 REVOLUTIONS
LINE SHAFT. 205 REVOLUTIONS
A
RING SPINNING FRAME TIN ROLLER SHAFT. 783 REVOLUTIONS
DE LAVAL TURBINE GEAR WHEEL SHAFT. 1000 REVOLUTIONS.
CROSS SHAFT IN SHED. 120 REVOLUTIONS
B
MAIN SHAFT OF LOOM. 190 REVOLUTIONS
MAIN SHAFT OF LOOM. 190 REVOLUTIONS
LINE SHAFT IN RING ROOM. MOTOR DRIVEN. 415 REVOLUTIONS
C
RING SPINNING FRAME. TIN ROLLER SHAFT 740 REVOLUTIONS

FIG. 3.

blades at the high-pressure end of a cylinder that had been exposed to very high steam temperatures, in such a ductile condition that the slightest pressure at the tips of the blades was sufficient to move them in any direction, and some of them had closed in to such an extent as almost to block up the steam passages.

In a textile mill, with its comparatively steady load, superheat should be obtained economically and without much temperature variation, if sufficient boiler power is installed to generate the steam required without recourse to forcing the fires.

For powers above 300 KW., there is little or no difference between the turbine and the reciprocating engine, when the former is worked with a good vacuum and superheated steam. Some full-load steam consumptions of turbines operating in textile mills are given in Table III.

TABLE III.

Maker's name.	Load in KW.	Steam pressure, lb. per sq. in.	Steam temp., degrees F.	Vacuum, per cent. of bar.	Steam consumption lb. per KW.-hour.
Brown, Boveri ...	1,400	188	500	96	15·99
... ...	1,500	158	482	91	16·98
A.E.G.	1,280	180	572	95	15·6
Brush Co. ...	459	198	550	94·9	17·86

Careful examination of the blades of reaction turbines that have been in service for a long period shows that no wear takes place, consequently the steam economy is not affected by age. This is an important advantage not possessed by either the reciprocating engine or the impulse type of turbine.

The only parts on which oil is used are the bearings and governor; the quantity of oil used per week in lubricating the 500-KW. Brush-Parsons turbine previously referred to averages about 1¾ gallons, the oil costing 1s. 10d. per gallon, and the remarkably low figure of 1s. 9d. covers the weekly cost of a 75-B.H.P. and a 225-B.H.P. De Laval turbine.

One attendant is sufficient to take charge of a 1,200-KW. turbine plant, whereas a similar sized reciprocating plant would require an assistant in addition to the man in charge.

The comparative costs of power plants arranged for mechanical and electrical driving are given in Tables IV and V. Either plant would be sufficiently powerful to drive 69,000 ring spindles for spinning 16's counts, with preparation machinery.

For the mechanical drive, an engine of the vertical inverted type, on the triple-expansion principle, has been adopted, it being the one from which probably the most even turning can be obtained.

In the other case a turbo-alternator is used to generate electric current for motors driving the line shafts. A cooling tower installation has been allowed for, on the assumption that the mill depends on a lodge for its condensing water.

The comparative running costs for a working year of 2,800 hours are given in Tables VI and VII. The steam consumed per I.H.P. per hour is taken as being the same in both cases, and allowance has been made in Table VII for the power used for condensing and operating the cooling tower.

TABLE IV.

Vertical inverted triple-expansion engine arranged for rope drive. 1,600 indicated H.P. Boiler pressure, 160 lb. Steam superheated to 500° F.

Engine with condensing plant	£5,900
Four Lancashire boilers, 30 ft. long by 8 ft. diam....	1,840
Economisers	600
Four superheaters	360
Mechanical stokers	720
Steam and feed pipes, &c.	600
Travelling crane, &c.	200
Boiler house and boiler and economiser foundations	1,600
Engine house and engine foundations	1,180
Capital outlay	£13,000

TABLE V.

Turbo-alternator, 1,100 KW., 500 volts, three-phase, 50 periods, 3,000 revolutions. Boiler pressure, 160 lb. Steam superheated to 550° F. Temperature of cooling water 75° F.

Turbo-alternator	£3,700
Surface condensing plant, feed pump and pipes, &c.	1,240
Four Lancashire boilers, 30 ft. long by 8 ft. diam.	1,840
Economisers	600
Four superheaters	360
Mechanical stokers	720
Steam and feed pipes, &c.	500
Travelling crane, &c.	90
Water cooler	400
Boiler house and boiler and economiser foundations	1,600
Engine house and engine foundations	650
Capital outlay	£11,700

TABLE VI.

Vertical triple-expansion engine, 1,600 I.H.P., at 1·65 lb. coal per I.H.P. per hour, including banking of fires.

	Cost per annum.	Cost in pence per I.H.P. per hour.
Coal, 3,300 tons at 10s....	£1,650	0·0883
Engine house labour	187	0·0100
Boiler house labour	95	0·0050
Oil and stores	100	0·0054
Upkeep and repairs	100	0·0054
Interest and depreciation on £13,000 at 10 %	1,300	0·0696
	£3,432	0·1837

At 1,600 I.H.P., cost per I.H.P. per annum, £2 2s. 10d.

TABLE VII.

Turbo-alternator 1,100 KW. (1,600 I.H.P.), at 2·4 lb. coal per KW.-hour, including banking of fires.

Kilowatt taken as being equal to 1·45 I.H.P.

	Cost per annum.	Cost in pence per I.H.P. per hour.
Coal, 3,300 tons at 10s....	£1,650	0·0883
Power for condensing and operating cooler...	55	0·0029
Engine house labour	125	0·0066
Boiler house labour	95	0·0050
Oil and stores	55	0·0029
Upkeep and repairs	60	0·0032
Interest and depreciation on £11,700 at 10 %	1,170	0·0626
	£3,210	0·1715

At 1,600 I.H.P. cost per I.H.P. per annum ... £2 0 0
At 1,100 KW. cost per KW.-year £2 18 4
At 1,100 KW. cost per KW.-hour ... ... 25d.

On the matter of electric driving, the author says the substitution of the turbine for the reciprocating engine in the driving of electric generators has been the means of making a considerable reduction in the prime cost of electrical installations, and it is now possible to equip a mill with a complete plant at a cost not much more than that required to install a modern steam engine and rope drive; consequently, if the production of yarn and cloth can be increased as claimed, and its quality improved by the adoption of the electric system of driving, a considerable increase in profits would result, even if the extra production only amounted to about 2 per cent.

The alternating-current motor on account of its simplicity is generally adopted for textile work, and as its speed depends almost entirely on the periodicity of the current delivered to it, which can only vary with the speed of the engine, it is very important that the prime mover should be of a type that will drive the generator with the smallest possible variation in the turning. With the turbine coupled direct to a high-speed alternator the electric power produced by the combination, when transferred to the line shafting in a textile mill through induction motors, will give a more uniform drive than can be obtained with any mechanical system.

In comparing the tachograph records shown, the difference in the mechanical and electrical drives will be noticeable. The ring spinning frames in each case were driven with belts from the line shafts.

The electrical drive is extremely reliable, and if the motors are made large enough to drive the load for which they are intended without undue heating they will give little or no trouble. When the group system of driving is employed it is usual to couple the motors direct on to the line shaft and run the shafting as fast as the machinery will allow. In a ring spinning room line shaft speeds up to at least 600 revolutions would be permissible.

The author does not favour the fixing of motors inside the mill; it is better to house them in a separate compartment where there is no dust, and where proper facilities for ventilation can be obtained, even though it may entail a slight increase in cost.

The comparative cost of complete mechanical and electrical installations arranged for driving the mill previously referred to are given below in tabulated form.

The electrical drive would be arranged on the group system, and the motors coupled direct to the line shafts, two motors being used to drive each line. The rope race would be retained for housing the motors and cables.

TABLE VIII.—Mechanical Drive.

Power plant (B.F. from Table IV)	£13,000
Rope pulleys, shafting, hangers, &c.	4,500
Ropes	700
Total capital outlay	£18,200
Running costs per I.H.P. per annum ...	£2 9s. 4d.

TABLE IX.—Electric Drive.

Power plant (B.F. from Table V)	£11,700
Shafting, hangers, &c.	3,200
Motors and accessories	3,000
Cables	1,100
Switchboard	600
Total capital outlay	£19,600
Running costs per I.H.P. per annum ...	£2 9s. 10d.

Electrical Operation of Textile Factories.

In December last a paper was read by Mr. C. H. Douglas before the Calcutta and District Institution of Mechanical Engineers, dealing with the above subject.

Touching on Indian matters more particularly, the author stated that one firm alone had equipped one jute mill and nine cotton mills with complete electrical driving from independent plants, and that as regarded power supply from an outside station, a new 400-loom jute mill on the Hooghly would find it advantageous to take power at ·45d. per unit, and a cotton mill in Bombay at ·5d.

A curious point in connection with the author's Indian experience was mentioned, touching on the usual allowance in driving power for stopped looms. In the mill in question, which has what would have been considered a phenomenal production some years ago, it was found that the usual allowance for stopped time was quite inadmissible with the electric drive, and in consequence the power taken was more than would have been expected. The owners were a little worried over this, until the financial results of the year's working showed that the extra production completely accounted for, and extinguished many times over, the value of this extra power.

The author pointed out that it was a mistaken idea to expect a reduced fuel bill; the total power costs only amount to about 2½ per cent. of the manufacturing costs in a cotton mill, so that 3·4 per cent. extra production would wipe out all the fuel costs.

It does not seem to be recognised that although the modern mill engine will govern within 1½ per cent., this is no guarantee of cyclic regularity, on which the maximum speed at which machines can run depends; nor does it obviate the torsional effects in long lines of shafting employed in mechanical transmissions.

The author considered that independently-driven ring frames and group-driven looms offered the most satisfactory arrangements, and that it was in the details of design that the secret of really successful electric driving lay.

In India the centralisation of the machinery obtained by electric driving, and the possibility which the latter confers, of obtaining at the switchboard an accurate knowledge of what is occurring in the mill, is a great advantage to the European staff.

Electric Drive in Textile Mills.

By Albert Milmow.

(*Abstract of paper read before the* American Institute of Electrical Engineers, *at Charlotte, U.S.A., March 30th*, 1910.)

It is the purpose of this paper to deal especially with the employment of electric power for the operation of textile mills, with particular reference to its commercial aspects, and especially in comparison with the old forms of steam drive.

First Cost.—The references which follow will be to new mills especially equipped for electric drive, in so far as first cost is considered, and not to mills already equipped with steam power. The figures are based on a plant of 25,000 spindles on moderately fine work, which requires a power equipment of about 1,000 H.P. The figures which follow are for everything included in a mill that is chargeable to the power plant:—*

Electric Drive.

Group drive throughout, all 2,300-volt motors. Power delivered at 2,300 volts.

Transformer house and switchboard room	£200
Belting	260
Motor support	80
Shafting	1,600
Boilers	240
Boiler setting	70
Boiler room	330
Reservoir	360
Piping	180
Motors	2,112
Transformers for low-voltage motors, 2 to 5 KW. ...	25
Transformers for lighting, 1 to 50 KW.	77
Switches for motors	60
Switchboard	300
Wiring and installation, including lighting ...	800
Freight on electrical apparatus	85
	£6,779

Mechanical Drive.

Boiler room, Engine room, Chimney	£3,200
Engine, 24-rope wheel, compound	3,500
Engine foundation	400
Boilers	1,200
Boiler setting	360
Smoke breeching	154
Condenser pumps and heaters	504
Reservoir and crib	1,300
Steam power piping	1,200
Ropeway and extra sprinklers	400
Shafting and structural steel work	2,411
Rope	120
Belting, main drive and counters	260
Lighting generator, belted, and switchboard ...	200
Marine engine generator, 10 KW., and switchboard	200
Lighting wiring, two-wire system	400
Total	£15,809

From the table it will be seen that the total cost of the power plant for steam drive would be £15·8 per H.P., while the cost for a similar electric equipment is £6·78 per H.P., or a saving of £9·02 per H.P. of plant capacity where the electric drive is used.

It is to be noted that all costs are included in these estimates, though it is quite usual for advocates of steam drive to take for its first cost only the costs of engines, boilers, piping, &c., neglecting such important items as building chimneys, belt-ways, condenser reservoirs and other items which are essential to steam drive, but which are not required where a mill is electrically driven. This difference in cost should enter into the cost of power, taking the interest and depreciation at 12 per cent., the lowest possible figure. However, it is obvious that if this same amount of money were expended in productive textile machinery the earnings would certainly exceed the 6 per cent. included in this figure as an interest charge.

Cost of Operation.—The cost of steam power in a textile mill is very difficult to determine. Fig. 1 shows a series of engine indications made for a period of one week, at 10-minute intervals. It will be noted that a very wide variation of power is shown, and only a very thorough and detailed set of indications, as shown here, will give a fair average of the amount of power.

It is customary with advocates of steam drive to make certain large deductions in a purely arbitrary manner from the total cost, for the values of steam used in processes of manufacture other than for power, such as dye-house operation, heating and slashing, and then to divide the remainder by a factor obtained by taking one or more engine indications.

It will be seen from fig. 1 that it is obviously erroneous to take any value for the total horse-power of a mill other than an average taken approximately as shown; even this, to obtain perfectly

*$5 taken as equal to £1.—Eds.

accurate results, should extend over a long period, embracing all the seasons of the year, as there are many variable quantities involved, such as the temperature of the mill, which varies with the seasons, the humidity of the air, and even the nature of the cotton staple.

These factors cause an extreme variation of power during, say, a year's period of as much as 20 per cent., and this variation is very noticeable in a day's or a week's run, as will be seen by the variations of power shown in fig. 1 on that part of the curve corresponding to Monday.

On account of using the same boilers for power and for other purposes it is difficult to obtain accurate figures on the cost of dye-house, heating and slasher operation in a steam-driven mill. Where boilers are used for making tests, it is usual to use a large-power boiler, which runs in an underloaded condition and hence inefficiently, and the steam is often carried in long systems of piping before it is utilised. In electrically-driven mills it has been

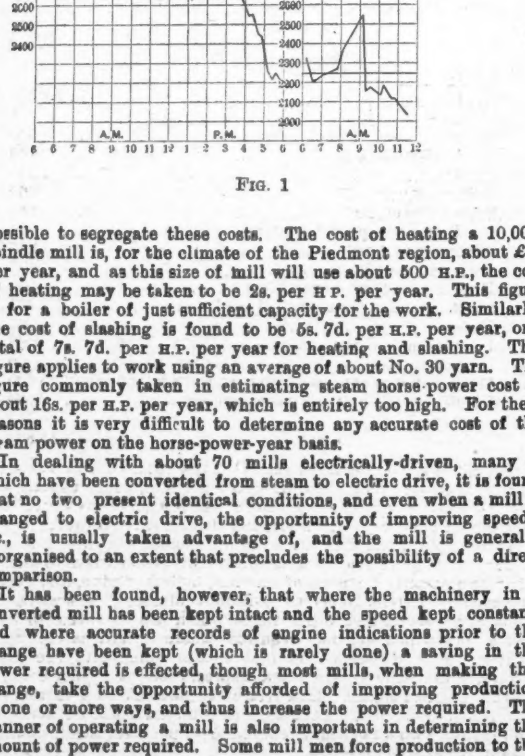


Fig. 1

possible to segregate these costs. The cost of heating a 10,000-spindle mill is, for the climate of the Piedmont region, about £50 per year, and as this size of mill will use about 500 H.P., the cost of heating may be taken to be 2s. per H.P. per year. This figure is for a boiler of just sufficient capacity for the work. Similarly, the cost of slashing is found to be 5s. 7d. per H.P. per year, or a total of 7s. 7d. per H.P. per year for heating and slashing. This figure applies to work using an average of about No. 30 yarn. The figure commonly taken in estimating steam horse-power cost is about 16s. per H.P. per year, which is entirely too high. For these reasons it is very difficult to determine any accurate cost of the steam power on the horse-power-year basis.

In dealing with about 70 mills electrically-driven, many of which have been converted from steam to electric drive, it is found that no two present identical conditions, and even when a mill is changed to electric drive, the opportunity of improving speeds, &c., is usually taken advantage of, and the mill is generally reorganised to an extent that precludes the possibility of a direct comparison.

It has been found, however, that where the machinery in a converted mill has been kept intact and the speed kept constant, and where accurate records of engine indications prior to the change have been kept (which is rarely done) a saving in the power required is effected, though most mills, when making this change, take the opportunity afforded of improving production in one or more ways, and thus increase the power required. The manner of operating a mill is also important in determining the amount of power required. Some mill men force production to the highest point, while others are content to run at moderate speeds and production.

The varying cost of fuel, the quantity and varying temperature of condenser water, and the difficulty of obtaining accurate data, make it impossible to arrive at any accurate conclusion regarding an average cost of steam-generated power in textile mills

In electrically-driven mills the absolute horse-power-hours and the indicated power can be determined at any time. An opportunity is given to check wastes and correct them, and a considerable amount of non-productive power is saved by the elimination of useless shafting.

Assuming the price of electricity to be £5 per H.P. per year for 11 hours per day, 306 days per year, and assuming a saving at equal production of 15 per cent. in power, which I consider conservative, the cost at which steam power must be generated to equal the price of electric power will be £4·25. From this must be deducted the fixed charges on the difference in first cost, which we may take at 12 per cent. on £9, or £1·08 per H.P. per year, leaving £3·17, plus £·38, which will be required for the heating and slashing operations of the mill, or a total of £3·55 as the figure at which steam power must be generated to be equal in cost to electric power at £5 per H.P.; and in this figure there must be included the cost of all oil, waste, labour, fuel, ash removal, coal handling, superintendence and, most important of all, the item of repairs, which is frequently omitted entirely in making estimates of steam power cost. If it were possible to attain this figure with a steam drive, a power only very inferior to electric drive would have then been obtained.

(To be concluded.)

PARLIAMENTARY.

London Tube Amalgamations.

On Thursday, last week, the Select Committee of the House of Lords, presided over by Lord Lamington, commenced the consideration of the Bill promoted for amalgamating the following three companies: Baker Street and Waterloo, Charing Cross, Euston and Hampstead Railway, and the Great Northern, Piccadilly and Brompton Railways. The promoters were represented by Mr. Roskill, K.C., Mr. Balfour Browne, K.C., and Mr. L. Maccassey. The London County Council and the Great Northern Railway entered a petition.

Mr. Roskill, K.C., in opening the case for the promoters, said that at present the three companies interested in the measure were controlled by three separate boards, and governed independently of each other. The Underground Electric Railways of London carried out the construction of the various lines, and were paid in debentures and ordinary shares. The greater part of the capital of the undertaking was possessed by the Underground Co. The traffic of the lines concerned had greatly developed both the local and the exchange traffic. The proposal now before the committee would undoubtedly still further develop the through and exchange traffic, for it would provide better facilities for the public. It was considered that the consolidation of the debenture stocks of the three companies would enhance the intrinsic value of those stocks, and improve the market for them. The debenture stock of the amalgamated company would be broadened and strengthened by resting on the development of the whole system. The same considerations were applicable to the preference shares of the Piccadilly and Bakerloo Companies. The issued capital of the three companies on December 31st, 1909, was as follows:—

	Debenture stock.	Preference shares.	Ordinary shares.
Piccadilly Co. ...	£1,575,956	£357,040	£5,047,960
Baker Street Co. ...	773,150	660,000	1,761,450
Hampstead Co. ...	1,442,000	—	4,326,000
Total ...	£3,791,106	£1,017,040	£11,135,410

The general scheme for dealing with the existing debenture stocks and shares under the proposed amalgamation is as follows:—

1. To consolidate the debenture stocks issued by the three separate companies into one stock of the Amalgamated Co. of the same nominal amount, adding thereto a sum of £408,894, required for the purpose of the Amalgamated Co.

2. To exchange the 4 per cent. preference shares of the Piccadilly and Bakerloo Companies for 4 per cent. preference stock of the Amalgamated price at par, and to exchange the £298,030 ordinary shares of the Bakerloo Co., held by the public, for 4 per cent. preference stock of the Amalgamated Co., in the ratio of £75 of new stock for £100 of existing shares, thus absorbing £1,240,563 out of a total issue of £8,150,000 new 4 per cent. preference stock.

3. To exchange the £10,837,380 ordinary shares of the three companies, held by the Underground Co. (of which £1,442,960 consists of ordinary shares of the Piccadilly Co. convertible into preference shares of that company), into £1,909,437 4 per cent. preference stock and £8,927,943 ordinary stock of the Amalgamated Co., making together £10,837,380, as above.

After providing for debenture interest, there was a surplus in 1909 on the Piccadilly Co. of £80,236, the Bakerloo £63,517, and on the Hampstead undertaking £31,447. The promoters were convinced that the value of through traffic was a factor in the development of a short urban railway. It was therefore considered that combination and consolidation of the three companies was in the best interests of the debenture stockholders and shareholders in each company. The Amalgamated Co. were providing the cost of presenting the Bill, which, with the transfer and capital duties, it was estimated would amount to £100,000. It was proposed to discontinue the guarantees of dividend on the debenture stock of the Piccadilly Co. and the preference shares of the Piccadilly Co. In consideration of this the Underground Co. were willing to give an option to the holders of existing preference shares of the Piccadilly Co. to sell such shares to the Underground Co., at any time during one month after the passing of the Amalgamation Bill, at the rate of £8 10s. per £10 share. According to an estimate of the results of the amalgamation in 1911, which would be the first complete year after the passing of the scheme, the surplus net revenues of the Amalgamated Co. would provide, with an adequate

margin, for the debenture interest and preference dividends respectively. The estimate showed that, after providing for debenture interest on £4,200,000 stock, there would be a balance available for dividend of £215,500. After paying 4 per cent. on the £3,150,000 preference shares, which would absorb £126,000, there would be left available for the ordinary dividend and reserve £89,500.

Sir George Gibb, the chairman of the three companies, gave evidence in support of the Bill. He stated that all the necessary consents of the debenture stockholders and the preference shareholders had been obtained, as required by the Act, to allow of the promotion of the Bill.

In answer to Mr. Pritchard, who represented the London County Council, Sir George said that they were willing to issue workmen's tickets which would be available over the whole system.

The witness then formally proved the preamble of the Bill, and it was passed.

Metropolitan District Railway.

The above Bill came before the Select Committee of the House of Lords, of which Lord Lamington is chairman, on Monday. The Bill was opposed by the owner of some property at Turnham Green and by the London County Council.

The Committee, after deliberating in private, passed the preamble of the Bill.

Charing Cross, Euston and Hampstead Railway.

The Select Committee of the House of Lords, of which Lord Lamington is chairman, considered the above Bill on Thursday and Friday of last week. Mr. Roskill, K.C., and Mr. Balfour Browne appeared for the promoters, and Mr. Szlumper represented the Gordon Hotels, Ltd., the proprietors of the Hotel Metropole, who opposed the measure.

Counsel, for the promoters, explained that the company were asking powers to extend their line down to the Embankment Station of the District and Bakerloo Railways. The company proposed to make a loop line running to a point under Hungerford Bridge, where they would have a station. Access would be provided either by lifts or by a passage to the stations of the Bakerloo and District Railways. They also proposed having two "lay bys," so that in the case of a train breaking down it could be shunted into one of them, so as not to interfere with the ordinary traffic. The work would entail an expenditure of about £208,000.

Mr. L. R. Vigers, a member of the Surveyors' Institute, called by the promoters, gave evidence relating to the effect of tube railways on property. He said that, broadly speaking, the effects on property of sinking subways and tunnels by the tube companies had been very little in comparison with the total amount of constructional work done. Where a shaft had been sunk there had been little or no injurious effect between the stations. The main spots where buildings had been affected was on station sites. The total amount paid by the promoters for damage caused on the whole of the system from Elephant and Castle to Edgware Road was only £4,584.

The opposition of the Gordon Hotels, Ltd., was then proceeded with. This company contended that there should be at least 10 ft. of London clay between the top of the tunnel and the Metropole Hotel.

Mr. D. Hay, the engineer to the Charing Cross Co., pointed out that there were several stations which had not been built on London clay. For instance, that at Warren Street was constructed on running sand.

On Monday, the case for the opposition having closed at the previous sitting,

Mr. Balfour Browne, K.C., replied for the promoters. He said that it was to the company's interest not to cause any injury to the Hotel Metropole, for if they did they would have to pay damages not only for actual injuries caused, but for loss of trade, &c. They had incorporated in the Bill a clause whereby they had agreed if any damage was done to any property, if an independent engineer said it was necessary, to underpin or otherwise strengthen the foundations of the building. The Committee had heard the evidence of Mr. Hay, the engineer to the company, who had told them that he had never had a case of damage caused to property through the construction of a tunnel underneath. There had been cases where buildings had suffered near a station, but there the method of construction was different. The promoters had also included what was known as "Lord Windsor's clause" in the Bill, and the hotel people could claim compensation under that.

Counsel explained, in answer to a member of the Committee, that under this clause a person could claim compensation for injury sustained by the construction of a tube railway. The general law originally only gave compensation when damage was caused by the working of a railway.

Mr. Hay, the engineer, replying to the Chairman, said that to construct the station at the Victoria Embankment Gardens side would prevent a connection with the Bakerloo.

The Chairman, after consulting in private with the other members of the Committee, said: The Committee are of opinion that the Bill should not proceed.

An application for costs by Mr. Szlumper on behalf of the proprietors of the Hotel Metropole was refused.

In answer to Mr. Roskill, the Chairman said that this decision applied to the opposed portion of the Bill.

Later in the day, Mr. Balfour Browne, K.C., said he had been in communication with the hotel people, with the result that he thought the promoters would come to some agreement with them. The company now suggested that the line should be removed a considerable distance away from the hotel. He accordingly asked that the Committee should allow the Bill to remain in the list.

Mr. Szlumper said he had not had an opportunity of consulting his clients, but he thought the proposal would meet with their approval. He, however, assented to Mr. Browne's application.

The Committee thereupon allowed the Bill to remain in the list.

Baker Street and Waterloo Railway.

This Bill came before the Select Committee of the House of Lords, presided over by Lord Lamington, on Thursday last week.

Mr. Roskill, in explaining the Bill, said that it proposed to improve the existing condition of things at Oxford Circus. They proposed to construct a subway at that station. The number of tickets issued at Oxford Circus in 1909 was 3,026,496, and no fewer than 2,485,806 passengers exchanged at that point. It was essential in the interests of the travelling public that improvements should be made at Oxford Circus. It was originally proposed that a passage should be made underneath the premises of Peter Robinson, but there was so much opposition to it, that they had struck out the clause dealing with that project. Under Clause 10 they proposed to alter the existing general law, but opposition was forthcoming on the part of the Home Office, who, in their letter, stated that they objected to the form in which the clause was worded, although they sympathised with the intention. It was essential that tube companies should provide a quick service, and as a matter of fact, there was sometimes only 100 seconds between the trains. There was a great deal of trouble caused by passengers who had not got their tickets, and the only thing the company could do in their circumstances was to take the name and address of the person. That mode, however, was insufficient, so the promoters in their Bill proposed to substitute another way of dealing with persons who travelled without tickets, than was at present provided for in the general law. They had, however, for reasons which he had stated, dropped that clause. The opponents to the Bill were Messrs. Nicholson & Co., mortgagees of some property adjoining the station, and Lord Howard de Walden, the owner of a block of buildings at the south-western corner of Oxford Circus.

Sir George Gibb gave evidence in support of counsel's statement.

Mr. D. Hay, consulting engineer to the company, explained that the cost of constructing the subway at Oxford Circus would be £17,000. It was proposed to have a cast-iron subway 17 ft. in diameter, running at an angle, inside which there would be a moving staircase, running both up and down. The staircase would be capable of holding 150 people each way. Mr. Albert Stanley, traffic manager to the company, gave similar evidence.

The opposition of Lord Howard de Walden was withdrawn, as it was announced the parties had come to an agreement. Having heard the opposition of Messrs. Nicholson & Co., the Committee passed the preamble of the Bill.

Wimbledon and Sutton Railway.

The Select Committee of the House of Lords, presided over by the Duke of Wellington, commenced the consideration of the above Bill on Friday last. Mr. Lloyd, K.C., Mr. Ram and Mr. Maccassey appeared for the promoters; and petitioners against the measure are the London and Brighton and South Coast Railway, the London and South-Western Railway, Lady Dunsaney, the owner of property at Wimbledon, and the owners and lessees of property at Sutton.

Mr. Lloyd, K.C., in opening the case, said that the Bill was promoted by a number of gentlemen who sought to be incorporated and asked powers to construct a railway from Wimbledon to Sutton. That would be a natural extension of the existing line from London through Putney to Wimbledon on to Sutton. The need for the line had been felt for many years, but no proposal such as was now before the Committee had ever been brought before Parliament. The population in the immediate vicinity of the existing lines had greatly developed, and the difference between the increase in the population of districts near the line and those which were not similarly served, was most marked. In the first instance, the population had increased largely, whilst in the second instance the number only showed a small advance. They would call evidence to show that the land through which the proposed railway would run was ripe for development. The witnesses would say that not only did they want the railway, but they were willing to financially support it. The recently issued Report of the Royal Commission on London Traffic teemed with evidence in support of the proposal now before the Committee. The promoters would call two members of that Commission to speak in support of the Bill—Sir George Gibb and Sir John Wolfe-Barry. There would be 10 stations on the proposed line, which would be about 5½ miles long, and would be part and parcel of the District Railway. Seven of the stations would be remunerative at once, whilst the other three would become so in a short time, and the railway would bring about that development which was so desirous. It was proposed to have a junction and termini at Sutton with the Brighton line. The station at Sutton would develop local traffic and put the persons in that district in direct communication with London. The present service was not such as commended itself to the residents of Sutton. The promoters had the support of every local authority through whose district the line would run, and, with the exception of two landowners, the support of every landowner in the vicinity. The capital of the

company would be £350,000, with one-third borrowing powers, and the engineer's estimate was £311,554. He would call evidence to show that there was no reason why, at an early date, a dividend of 5 per cent. to 6 per cent. should not be paid, and leading members of the Stock Exchange would tell them that there was no reason why the capital should not be easily subscribed. He therefore asked the Committee not to act upon the allegations of the Brighton Railway Co. that the money could not be raised. The real opponents to the measure were the London, Brighton and South Coast Railway. The promoters proposed to have a junction with the Brighton Co. at Sutton, but if they did not want it, he was prepared not to go on with that proposal, and would strike it out of his Bill. There was also a proposal for making a junction with the London and South-Western Railway at Wimbledon, but if that was objected to, as "being fraught with danger," in the words of the South-Western petition, he was prepared to abandon that proposal.

Mr. H. D. Searles Wood, the chairman of the syndicate who are promoting the Bill, gave evidence in support of it, and the Committee adjourned.

The greater part of Monday's proceedings were occupied in hearing evidence from local witnesses and representatives of the various local authorities through whose district the line will run. All of them spoke in favour of the Bill, and as to the advantages which the railway would afford to the neighbourhood.

Mr. V. Graham, engineer to the promoters, gave evidence. He said that the estimates were as follows:—For the construction of the line £181,140, acquisition of the necessary land £130,413, making in all £311,553. There would be 10 stations on the line, and it was suggested that there should be a junction at the Sutton and Merton ends with the London-Brighton and the South-Western Railway Companies respectively. He could not understand the opposition of the Brighton Co., for it seemed to him they had everything to gain and nothing to lose. The proposed railway would undoubtedly take a certain amount of local traffic to the Brighton Co. There would be a short cutting at Wimbledon and the highest bank would be 21 ft. The ruling gradient would be 1 in 40, and the steepest 1 in 20. The sharpest curve would be 8 chains in length.

The Committee adjourned.

Handsworth U.D.C. Bill.

On Thursday last week a Select Committee of the House of Lords, presided over by the Earl of Kintore, had before them the Bill promoted by the Handsworth Urban District Council, which asked for further powers in respect of the electric lighting undertaking and streets, &c., and also for the construction of about 4 miles of tramway, the estimated cost of which was £67,500. Mr. Talbot, K.C., and Mr. Clode appeared for the promoters; Mr. H. Lloyd, K.C., and Mr. C. C. Hutchinson for the Birmingham Corporation; and Mr. R. S. Cleese for the objecting frontagers.

Mr. Talbot, K.C., in opening the case, said the only opposition was to the tramway portion of the Bill. Handsworth had a population of 72,000, and the Urban District Council owned a length of tramway in the Holyhead Road which was electrically equipped and leased to the South Staffordshire Tramways Co. The lease expired next year. The current was supplied by the U.D.C. The Council also owned a tramway in Birchfield Road, but to get by this to the centre of Birmingham it was necessary to go through Aston, where it had been necessary to get through running powers to avoid charging three separate fares to passengers. Next year the whole of the existing tramways would come into the possession of the District Council, and consequently the Council asked for powers now so as to be able to make a complete scheme. The net cost to the Council of the whole scheme would be £203,875, and the estimated revenue was ample for sinking fund, interest and depreciation.

Mr. Alfred Sanders (chairman of the District Council) was called, and described the existing tramways, which would come into the possession of the Council, and also the proposed new tramways.

A number of residents were called to speak as to the need for further tramway accommodation, and Mr. H. Richardson, surveyor to the Council, spoke as to the development of the district, and also expressed the opinion that frontagers would be amply protected.

Sir Alex. Kennedy, consulting engineer to the promoters, said the new tramways were intended to link up existing tramways to Birmingham, and would form part of the system of through east and west running. He estimated the revenue at 9½d., and the working expenses at 6½d. per car-mile, and that the residue would meet capital charges and depreciation. This concluded the case for the promoters.

Mr. Alfred Baker, manager of the Birmingham Corporation Tramways, was called for the opposition, and expressed the opinion that the tramway proposals of the Bill were absolutely unnecessary. He believed the Heathfield Road line could never be made to pay its expenses. Handsworth were already losing £3,000 a year on the piece of line they had, and under the proposals of the Bill they would lose more. If the promoters diverted the line from Heathfield Road along Birchfield Street, they would sterilise the tramways already laid, and on which they had spent from £7,000 to £8,000. The Birmingham working expenses were 7½d. per car-mile, and he did not think Handsworth could run at less than this.

In cross-examination, Witness denied that the promoters were placed at the mercy of Birmingham, for no obstacle had been put in the way of through communication. He suggested that the tramways should be worked as part of a great scheme, and that the local authorities should have regard to this important consideration. Birmingham had inter-communication with all the outside districts.

Mr. H. Lloyd, K.C., pointed out that there were proposals before the Local Government Board to include Handsworth in Birmingham, and if the Bill passed he would ask the Committee to delay their observations until this issue was determined.

Mr. Clode appealed to the Committee not to hang up the Bill until the question of incorporation with Birmingham had been decided. Handsworth had spent £117,000 on their tramways, and ought not to be prevented from getting a return on their capital.

After private consultation the Committee decided to pass the tramway portion of the Bill.

Post Office Factories.—In Saturday's Parliamentary Papers Mr. Tyson Wilson asked the Postmaster-General, in reference to the Departmental Committee he is about to appoint to investigate the conditions appertaining to the Post Office factories, whether he will seriously consider the advisability and necessity of including on the committee officers of the society representing the workers in the said factories. Mr. Herbert Samuel says that the committee which he has appointed will not carry out any direct investigation into the conditions of employment at the Post Office factories, a matter which formed part of the subject of the inquiry by the recent Select Committee of the House on Post Office servants. The Departmental Committee will inquire into the organisation and equipment of the factories and analogous questions. Although he hoped an important result of their inquiry might prove to be a greater regularity of employment for the workmen engaged, he did not think the committee was one on which a representative of the workers' society would serve with advantage.

Post Office Contracts.—Mr. Newman asks whether, in contracts for the supply of instruments or other goods that may be obtained by firms having establishments abroad as well as in this country, a clause is or is not inserted limiting the whole process of manufacture to the works situated in this country. Mr. Herbert Samuel replies that no such clause is inserted in the contracts, but he is giving the matter consideration.

Yorkshire Electric Power Co.—The Bill promoted by this company for the rearrangement of its capital passed the House of Lords Committee stage on Tuesday.

Second Reading.—In the House of Commons on Tuesday the Bishops Stortford, Harlow and Epping Gas and Electricity Bill was read a second time.

Devonport and District Tramways Bill.—This Bill occupied Sir J. Compton Rickett's Committee for three days, after which the chairman said that the company had failed to make good their case. Our report of the proceedings will appear later.

LEGAL.

The Electrical Co. *v.* Thomas, Son & Co.

This action is still steadily progressing before the learned Official Referee, Mr. Pollock, and is expected to last many days yet. It will be remembered that the Electrical Co. sued Messrs. Oliver Thomas, Son & Co. for the balance of cost of an electrical pumping plant which they contracted to put down in the defendants' coal mine in the Llynvi Valley, South Wales. The plant was required by the defendants to take the place of a steam pumping plant and to unwater the mine. Defendants refused to satisfy the plaintiffs' claim because, they alleged, the plant supplied was inefficient and did not carry out the work required of it. They counterclaimed some £30,000 damage in respect of this alleged non-efficiency. The case has had a hearing in London of 28 days, and five days in Swansea before the Referee, who is now dealing with this counterclaim, and plaintiffs are endeavouring to show that the mine never could have been worked at a profit, and that the cost of working the coal was some 50 per cent. more than the f.o.b. selling price.

We are credibly informed that the cost of this lengthy action has already amounted to some £8,000 to £10,000. The correspondence is very voluminous, some 4,000 letters having passed between the parties.

Anns *v.* Walker.—Libel Action Appeal.

This case came on Friday before the Court of Appeal, consisting of Lords Justices Vaughan Williams, Moulton and Farwell, upon the application of the defendant for judgment or a new trial in the action which was tried before Mr. Justice Grantham and a special jury.

In this case the plaintiff, Mr. A. Anns, the secretary of the National Telephone Co., brought the action against the defendant, Mr. T. C. Walker, who was formerly in the share department of that company, for alleged libel. Defendant pleaded justification.

Plaintiff's case was that the defendant had been dismissed for refusing to obey the orders of his superiors, but was re-employed by the company till 1907, when he wrote to the directors to make a complaint about the plaintiff. The directors did not accept the defendant's views, and defendant then threatened to write a circular to the shareholders. Defendant was again dismissed, and the defendant wrote a letter of apology to the plaintiff, in which he stated that he admitted that he had declined to obey the plaintiff's

instructions to certify certain transfers, such transfers being quite in order; that it was untrue that the plaintiff had ordered him to certify transfers without the production of the certificates; that the defendant was alone responsible for obtaining the signatures of directors to blank forms of dividend warrants, and that it was untrue that the plaintiff knew of the irregularities and permitted them. For the defence it was contended that the plaintiff had not been charged with dishonesty, and that the defendant had merely alleged that irregularities were permitted, and that the dividend warrants were sent out under an improper system. Defendant stated that he wrote the apology because that was the only way he could obtain an interview. Plaintiff only asked for nominal damages, and the jury awarded him a sum of 20s. as damages; the learned Judge entered judgment accordingly, and granted an injunction restraining the defendant from publishing similar libels in the future. Hence the present appeal of the defendant.

At the conclusion of the arguments of counsel for the appellant, and without calling upon counsel for the respondent, their Lordships dismissed the appeal, with costs.

Boulton *v.* Perry & Co., Ltd.

On Thursday and Friday last in the King's Bench Division the case of Boulton *v.* Perry & Co., Ltd., was heard before Mr. Justice Hamilton sitting to deal with commercial causes. In this case Mr. Sidney Alexander Boulton, of Inverness Terrace, London, was the plaintiff, and the defendants were Messrs. Perry & Co., of Tredegar Works, Bow. The plaintiff claimed the sum of £2,557 9s. 10d., as assignee by a deed of March 15th, 1909, of which notice had been given to the defendants—a debt due from the defendants to Messrs. Blackburn, Starling & Co., Ltd. The sum claimed is the amount certified by Mr. E. W. Bowles, consulting engineer of the Piccadilly Hotel, to be due to Messrs. Blackburn, Starling and Co. as the final instalment of payments for the electric lighting and power installation at the Piccadilly Hotel. The defendants, in their pleadings, said it was a term of the contract between them and Messrs. Blackburn, Starling & Co., that defendants should only be liable to pay when they received the money from the Piccadilly Hotel. To this plaintiff replied that if defendants had not received payment, it was because they departed from the terms of their contract, and were thus unable to obtain the certificates for payment.

Mr. Scrutton, K.C., and Mr. Hill were for the plaintiff and Mr. J. A. Simon, K.C., and Mr. R. F. Colam, for the defendants.

Mr. Scrutton, in opening the case, said so far as he could understand the matter, which was somewhat complicated, Mr. Bowles, the engineer, who ought under the contract to have certified for 100 per cent. of the electric light work that was done, never did so, but only certified for a lump sum, which included 80 per cent. of the electric work. He then sent the certificate to Mr. Woodward, the architect, who added 15 per cent. to it and included it in a lump sum which covered other items, and gave the certificate to Perry & Co. This was for a large sum—some £27,000 or £30,000. Thus, Messrs. Blackburn, Starling & Co. got what they ought to receive under the contract, but Perry & Co. did not get what they were entitled to. They ought to have had 100 per cent. with 15 per cent. added for profit, according to their contract. Messrs. Perry & Co. were bound to get from the Piccadilly Hotel Co. a certificate for the full value of the electrical work done from time to time, and their contract would enable them to do so if it was enforced.

His Lordship: You say that whether you or Perry misunderstood the contract does not matter, and that defendants must be treated as not having insisted on their rights.

Mr. Scrutton agreed.

Mr. Colam said the question was whose duty it was to get the certificate from Bowles. He thought it was the duty of Blackburn, Starling & Co.

Mr. Scrutton said his contentions were, first, that the defendants had received enough money to pay plaintiff; secondly, if they had not received it, it was because they had not insisted on their rights; thirdly, as to the question of extras, he had certificates that the whole of them were due to be paid.

Mr. Colam said there were conditions precedent to the payment of the money which it was for his learned friend to show had been satisfied, and that he had not done. During the whole of the correspondence the plaintiff had never once alleged that the defendants had not insisted on their rights. Defendants told plaintiff that they would pay as soon as they got the money themselves, and no question was raised upon it. It was not the fault of the defendants that they were not paid in full. Messrs. Blackburn, Starling only asked for 80 per cent. instead of 100 per cent., and they handed over that exact sum to defendants, who received it, and were not bound to insist on the extra 20 per cent.

The case was adjourned to Monday.

On Monday, Mr. J. A. Simon, K.C., arguing on behalf of the defendants, pointed out that Messrs. Perry & Co. had no kind of check on the work done. The work was not done to their specification, but had to be done to the satisfaction of Mr. Bowles, the engineer to the Piccadilly Hotel Co. With respect to the "extras," it was necessary to bear in mind that Messrs. Blackburn, Starling's work was not work which the defendants specified, and that any extras which had been necessary were not ordered by defendants, nor was it work which had to be done to their satisfaction. It was ridiculous to say that it was the fault of the defendants that the money was not paid, because they had not fulfilled the condition precedent to the payment. It was impossible in the face of the documents which existed in the case to say such a thing. The amount of money that was to be paid, and the time at which it was to be paid in respect to the contract with Blackburn, Starling & Co., was settled with the active assistance of that firm, and was arranged between them and Mr. Bowles. It was impossible for Perry & Co. to be aware of the state of the account, as it was quite clear Blackburn's gave directions in the matter. The sole function of Messrs. Perry & Co. was to be an inanimate conduit through which the money was to pass. Messrs. Perry had always recognised their responsibility to pay the money after they got it, but as they had not got it, he submitted they were not liable to pay anything. There was nothing in the contract which made it the duty of Perry & Co. to apply for certificates. The clause which related to that matter, no doubt set up conditions precedent, but it did not make the conditions inter-dependent. Messrs. Blackburn and Bowles were the only people who knew the actual course of the work, and there was nothing which justified the inclusion of Messrs. Perry as responsible parties.

Mr. Scrutton replied on behalf of the plaintiff, and said Mr. Bowles was the judge who was provided under the contract to "adjust the accounts" between the parties interested in the matter. As to the business aspect of the affair, Messrs. Blackburn had a contract with Perry & Co. to whom they were to look for payment, and they had no right to look to anyone else. Perry & Co. had received more than the amount they were liable to pay to plaintiff, and they had no right to keep it in their pockets when the work had been done by others. To allow that would be a perversion of ordinary business principles. Defendants having, in fact, received some £17,000, they could not turn round and say they were not liable to pay Messrs. Blackburn's debt as they had not received all that was due to them.

His Lordship, in giving judgment, went at great length into the circumstances in dispute. He said the decision on the preliminary question was that through the application of Perry and Co. to pay the amount there was a condition precedent, as stated in the contract. The plaintiff now made two points on that—first, that the condition precedent was fulfilled prior to the commencement of the action. Secondly, by delivering a reply subsequent to his first decision on the preliminary issue, they contended that if that condition precedent had not been fulfilled the defendants themselves were responsible for it, either by omitting the duty to procure its fulfilment or by interfering so as to prevent the fulfilment, and therefore the question came now to be tried independent of any question as to the performance of the condition precedent. Plaintiff said there were two items—the sum of £1,686 the balance of the lump sum in the contract of June 22nd, 1907, to which alone any question of condition precedent could apply, and also the sum of £1,066 3s. 6d. for "extras," for which Perry & Co. would be liable to Blackburn & Co., but not performed subject to the conditions imposed by the contract. He thought the intention of the contract was that Perry & Co. were not to pay the sub-contractors, Blackburn & Co., unless and until they had received the payments. But he thought it quite clear that the whole of the parties were quite aware that the course of business laid down in the contract was not being pursued. It was manifest that Messrs. Perry knew it, because, in some cases, they paid over the whole of the money they had received, and not merely 80 per cent. of it, as provided in the contract. He had been invited to come to the conclusion that the contract had, by consent, been varied, but he saw no evidence on which he could adopt that course, and he must proceed on the footing of the formal contract, though he must say the point seemed hardly worthy of all the time that had been given to its discussion. Mr. Scrutton, for the plaintiff, had said that the condition precedent was performed because the sum paid for the work had been £17,464; but it was not a question of money "had and received" by Messrs. Perry & Co. for Messrs. Blackburn, Starling & Co. It was said that business justice required that if Perry & Co. had received £17,000 for electrical work they should perform their part of the contract and pay £16,865, but that after all brought them back to the point whether they were bound to pay it. He preferred to hold the parties to their contract rather than to endeavour to administer business justice which might not be the same thing as the law of England. On the whole, he must come to the conclusion that it was the business of Messrs. Blackburn & Co. to get the certificates, and not the business of defendants, and he found no evidence of obstruction, interference, or hindrance to the getting of the certificates on the part of defendants which had been alleged. That disposed of the question with regard to the sum £1,686. With regard to the other sum of "extras" £1,066, he thought there was no more ground for saying the condition precedent had been fulfilled than there was with regard to the principal claim. He, therefore, held that the plaintiff claim in that respect failed also, and there must be judgment for the defendants with costs.

A stay of execution was granted on the application of plaintiff on the usual terms.

The National Lighting Corporation, Ltd.

On Monday, April 11th, Mr. Justice Neville had before him in the Chancery Division an application for relief under the Companies' Consolidation Act of 1908, in respect to the filing of a contract to issue shares as fully paid.

Mr. Edwards, who made the application on behalf of Mr. Alfred Hanger, said that the company was a private one formed for the purpose of acquiring a business for the sale of electric lamps. The memorandum was signed by Mr. Hanger, Mr. Isidore Frobein and Mr. Samuel Munger. There was a verbal contract by which the company was to allot 248 shares to Hanger, 249 to Frobein and 799

to Munger as fully paid up in consideration of the purchase money for the business, and a contract by the company to pay for certain goods that had been supplied. These contracts had never been registered in accordance with the terms of the Act. The matter came before the Court, when it was referred to a special referee to determine what was the contract between the applicant and the company, and why the contract was not filed. The referee had found that these gentlemen had formed the company without sufficient knowledge of the terms of the Act, that they had no legal assistance, and that the mistake was due to their ignorance of the law.

There was no opposition, and his Lordship extended the time for registration for 14 days from the date of application.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NIGERIA.—The importer of goods into Nigeria must present to the Customs an invoice in duplicate giving a full description of the goods in detail, the quantity and value of each kind of goods imported and the marks and numbers on the packages so as to show truly the quantities and values of the articles in each package. The packages must be legibly marked and numbered on the outside when they are of such a character as to enable the marks and numbers to be placed thereon. The bills of entry for imported goods must also state the country of origin of the goods. Under special circumstances the name and address of the firm from whom the goods were purchased and the date of purchase may be required by the Customs. Invoices for goods valued at more than £10 must be attested by the owner or exporter in the country of exportation, before a person authorised to administer oaths, but the law will be regarded as having been complied with and clearance will be permitted on unattested invoices if an undertaking is given to furnish attested invoices if required.

The following goods are admitted free of duty:—

All goods imported with the sanction of the High Commissioner for the service of any public department; mathematical, scientific and surgical instruments; mining, agricultural and industrial machinery and implements; telegraph and telephone materials; wheeled vehicles of all kinds and their accessories attached thereto; winches, derricks and cranes, whole or in part, and machinery necessary for working the same.

Goods not specially mentioned pay a duty of 10 per cent. *ad valorem*; the value on which duty is calculated is the fair market value of the goods when sold for home consumption in the principal markets of the country whence and at the time when they were exported directly to Nigeria.

No person is allowed to establish or use any apparatus or installation for the purpose of electrical communication by wireless telegraphy in Nigeria without a licence from the Governor.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,573. "Improved form of single-phase alternate-current motor." R. C. Black. March 29th.

7,574. "Apparatus for determining the position of faults in electric mains." R. A. D. Macalister. March 29th.

7,587. "Improvements in and relating to prepayment electricity meters." W. N. Goddard. March 29th.

7,589. "Improved method of resuscitating the negative plates of secondary batteries and assisting in their formation." J. M. Gorham. March 29th.

7,593. "Improved device for use in charging electrical accumulators." T. E. Smith. March 29th.

7,617. "Electric igniter for explosion motors." L. Podszus. March 29th. (Complete.)

7,621. "Electric train-control system." F. W. Prentice. March 29th. (Complete.)

7,639. "Improved method of and apparatus for igniting the combustible mixture in reversible internal combustion engines." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, March 29th, 1909, being date of application in Germany.) March 29th. (Complete.)

7,641. "Improvements in current terminals for use in the manufacture of mirrors by electro-deposition." A. G. Bloxam. (Firm E. Hoorickx and A. Hindel, Belgium. Application for Patent of addition to No. 2,490/09.) March 29th. (Complete.)

7,656. "Improvements in or relating to cooling devices for telephone transmitters for strong current." C. E. Egnee and J. G. Holmstrom. (Date applied for under Sec. 91 of the Act, April 3rd, 1909, being date of application in Sweden.) March 29th. (Complete).

7,659. "Improvements in and relating to automatic telephone systems." E. Neuhold. (Date applied for under Sec. 91 of the Act, April 30th, 1909, being date of application in Germany.) March 29th. (Complete.)

7,688. "Mechanism for automatically and electrically operating a kinematograph." B. Fothergill. March 30th. (Complete.)

7,808. "Electric current generating and motive power machine." W. S. Frost. March 31st.

7,821. "Improvements in electric arc lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H. Germany.) March 31st. (Complete.)

7,822. "Improvements in or relating to the starting of polyphase electric asynchronous motors." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H. Germany.) March 31st. (Complete.)

7,823. "Improvements in electrical distribution boards and safety switch fuses and fuse carriers." J. F. Conradi and E. S. Conradi. March 31st.

7,851. "Device for sending current impulses, particularly applicable to automatic telephone systems" Deutsche Telephonwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, November 8th, 1909, being date of application in Germany.) March 31st. (Complete.)

7,860. "Improvements in electric heating apparatus." British Thomson-Houston Co. (General Electric Co., United States.) March 31st. (Complete.)

7,868. "Improvements in electrical generators or motors." J. McDonald. April 1st.

7,882. "New or improved electric distributor for domestic electric cooking, heating and like appliances." H. Gray. April 1st.

7,910. "Portable electro-therapeutic massage brush." V. von Vangel. April 1st.

7,929. "Improvements in and relating to electric fittings." J. S. Highfield. April 1st.

7,966. "Improvements in anti-vibrator devices for electric and other lamps or burners." C. J. Sutton. April 2nd.

8,005. "Improvements in and relating to the electric generation and electric superheating of steam." G. de Holden-Stone. April 2nd.

8,014. "Improvements in and relating to electric lampholders." J. W. Buck. April 2nd.

8,015. "Improved electric trolley or rope railway roller." W. Kremer. April 2nd.

8,018. "Improvements in or relating to variometers for electrical oscillations." W. P. Thompson. (G. G. von Arco, Germany, and R. H. Rendahl, Sweden.) April 2nd. (Complete.)

8,019. "Improvements in or relating to cooling devices for telephons transmitters." C. E. Egner and J. G. Holmstrom. (Application for Patent of Addition to No. 7,656, 1910.) (Date applied for under Sec. 91 of the Act, June 29th, 1909, being date of application in Sweden.) April 2nd. (Complete.)

8,024. "Improvements relating to telephonic transmitters." E. A. Graham. April 2nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Electric Terminals. G. E. Tate. 5,302. March 4th.

Devices for Controlling Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 5,418. March 5th.

Wireless Electric Fog Signalling Apparatus. G. Hughes. (M. A. Murray.) 5,685. March 9th.

Totally De-energising Overhead Dangerous Electric Wires the Moment they Snap. D. P. F. Ghadiali. 6,111. March 15th.

Electric Accumulator. H. W. Twaites. 6,770. March 22nd.

Electrical Cartridge Fuse Holders. J. Ford and E. E. Bonshor. 8,212. April 5th.

Electric Signalling Systems for Railways. W. J. Higgins and C. J. Sheridan. 9,035. April 16th.

Electrical Sliding Contacts. B. von Ugrimoff. 10,175. April 29th.

Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. (General Electric Co.) 10,594. May 4th.

Galvanic Batteries. Patterson. 11,154. May 11th. (Date applied for under International Convention, May 25th, 1908.)

Pocket Magnetic Compasses. C. W. Somerset and A. F. C. Bentley. 12,203. May 24th.

Electrodes for Electric Furnaces. M. Ruthenburg. 12,507. May 27th.

Electrodes for Electrolytic Purposes. Electrolytic Alkali Co., C. C. Connor and J. W. Stubbs. 12,709. May 29th.

Magneto-Electric Massaging Machine. S. Seacombe. 12,844. June 1st.

Switchboards for Electrical Installations. British Thomson-Houston Co., and G. Richardson. 13,655. June 10th.

Arc Lamps. A. J. Boult. (Voigt & Haeffner Akt.-Ges.) 14,128. June 16th.

Telephone System. D. W. May. 14,244. June 17th.

Wireless Signalling. R. A. Fessenden. 17,450. July 27th. (Date applied for under International Convention, March 8th, 1909.)

Magneto-Electric Machines. T. M. Mueller. 17,634. July 29th. (Date applied for under International Convention, February 25th, 1909.)

Multiple Distributor for Electric Ignition Apparatus. Firm of Robert Bosch. 18,594. August 11th. (Date applied for under International Convention, July 20th, 1909.)

Device for Electrically Igniting Gas-Burners and the like. F. F. Dier and M. Primeau. 18,679. August 13th.

Current Distributors for the Ignition Devices of Internal-Combustion Engines. Firm of Robert Bosch. 20,656. September 9th. (Date applied for under International Convention, April 7th, 1909.)

Electric Fuses. O. Nordentoft. 25,145. November 4th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 28,362. December 4th.

Plug and Socket Connections used in Electric Lighting and Power Installations. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 29,582. December 17th.

Japan.—An American Consular report gives some details of the British-made 150-ton hammer-head crane at the Mitsu Bishi Dockyard and engine works at Akunoura, Nagasaki. The crane is 177 ft. high and is operated by five 200-volt 50-H.P. motors for the various motions. One man can control the crane from a cabin underneath the main girders, which carry at one end, in a housing, the hoisting and traversing gear. To prevent accidents, the crane is fitted with automatic devices to guard against over-running, failure of the electric supply, or illness on the part of the driver.